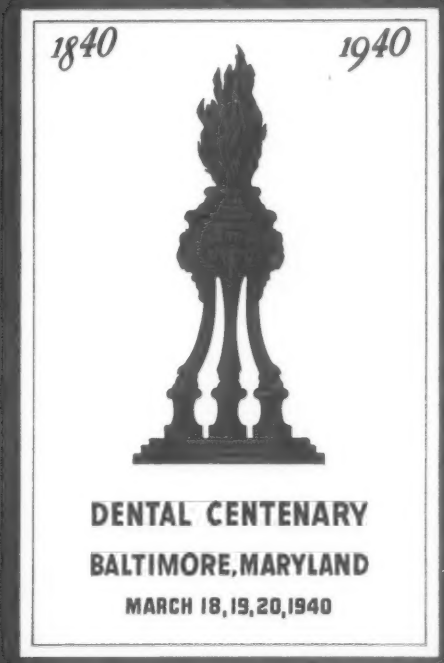
The Journal

OF THE

AMERICAN DENTAL ASSOCIATION



PRELIMINARY PROGRAM DENTAL CENTENARY

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THE BACTERIOLOGIST LOOKS INTO THE PATIENT'S MOUTH

By J. L. T. Appleton, D.D.S., Philadelphia, Pa.

MOST people are supposed to see only what they are looking for. The chemist sees colloids and crystalloids, molecules, atoms and ions and, if he looks hard enough, would, I am sure, see electrons and protons. The histologist sees cells, cell aggregations and intercellular substances, and the bacteriologist doubtless sees bacteria.

The "bacteriologist" who, beyond question, first "saw" bacteria in the human mouth was the plodding, homespun, self-made and self-taught Dutchman Antonj van Leeuwenhoek, a man naive and shrewd, and possessed of an insatiable and promiscuous curiosity. He was in the linen trade and also held a political appointment which had something to do with the supervision of the liquor traffic in his home town. To escape from ennui, which must have hung as heavy around him as a Dutch fog, he took to making magnifying lenses and examining therewith everything imaginable. In a letter dated September 17, 1683, he wrote, "The number of these animals in the scurf of a man's teeth are so many that I believe they exceed the number of men in a kingdom."

For various reasons, this lead was not followed up, and almost 200 years were to pass before significant contributions were made to the bacteriology of the mouth.

Pathogenic actinomycetes were found in the human mouth in 1878. In 1881, Pasteur, in France, and Sternberg, in this country, independently and accidentally, in seeking in saliva the cause of rabies, isolated the organism known today as the pneumococcus. Loeffler, in his first published description of the diphtheria bacillus (1884), reported the finding of this important pathogen in the mouth of a child. Among the other, for the most part occasional, inhabitants of the human oral cavity, we shall have to include the common pyogenic cocci; the gonococcus and other members of the genus *Neisseria;* many strains of streptococci; Friedländer's bacillus; the colon bacillus; *Ps. aeruginosa;* the bacilli of anthrax, typhoid fever and tuberculosis; the "influenza"

From the School of Dentistry, University of Pennsylvania.

Read at a meeting of the American Academy of Dental Science, Boston, Mass., October 1939.

bacillus and its relatives; the anaerobes of gas gangrene and tetanus; members of the *Brucella* group, and the spirochete of syphilis. This rather disquieting list is not exhaustive, but fortunately its more notorious members seem to be only occasional visitors to the human mouth, and even then only as transients. Considering the position and function of the mouth—the intake of food and drink, the constant exposure to the air, the habit of introducing fingers, pencils, etc., into the mouth—it would be surprising indeed if sooner or later every known micro-organism were not isolated from the human oral cavity, if the bacteriologist only looked for them persistently enough. The important thing is not that so many pathogens have been found in the mouth, but that, with rare exceptions, these unwelcome immigrants do not succeed in gaining a foothold. In competition with the old native stock, the "resident" flora, to adopt an expression which P. B. Price has used in connection with the analogous flora of the skin, these undesirables go under. The mechanisms that are responsible have received too little attention in view of the essential part they play in the natural defences against respiratory and gastro-intestinal disease, as well as against disease of the oral mucosa.

Leaving these more general bacteriologic problems, I shall now concentrate on some of the bacteriologic problems raised by the commoner oral diseases and the exigencies of general practice.

DENTAL CARIES

Bacteriologic studies to date have failed to supply the profession with a generally accepted, reliable, cheap and simple method of preventing tooth decay. Certain tests are available which, either in their present form or as perhaps later perfected, may serve as indices of the efficacy of measures proposed to prevent or control dental caries.

The attempt to sterilize dentin before inserting a filling, with the intent of preventing recurrence or extension of decay, is doubtless an accepted detail of good operative practice. In my laboratory, Dr. Seltzer has found that the use of ethyl alcohol as a vehicle for antiseptics employed for this purpose detracts greatly from the efficiency of the antiseptic in sterilizing dentin. Morson's creosote, long ago recommended by C. Edmund Kells, made the best showing, with 10 per cent iodine in aqueous potassium iodide solution and full strength liquid phenol close seconds. Straight operative procedure, the removal of dentin by dental instruments, especially if the cavity was small, was shown to be a remarkably effective means of obtaining a foundation of sterile dentin on which to place the filling. This finding at once stresses the value of good operative technic and of filling cavities in their earliest stages.

We often hear the statement that the clinician has made himself entirely dependent on the laboratory. It is, in this connection, refreshing to realize that probably no dentist would think of sending a patient to a bacteriologic laboratory or of resorting to bacteriologic measures to determine whether dental cavities were present and, if present, the number, size or location. The dentist might take a bite-wing roentgenogram and he might value the opinion of a roentgenologist, but to consult a bacteriologist on such a point, never! And this is as it should be. But will the dentist always be content with recognizing only the presence or absence, the number or size or location of dental cavities? Will he not want to know something of the degree of intensity or rapidity of the carious process? Will he not want to be able to anticipate by weeks or months an activation or a reactivation of the carious process? Such knowledge would be an asset to preventive dentistry. Bacteriologic studies have already taken steps to supply this need. I have in mind the quantitative determination of (1) oral lactobacilli (and yeasts) and (2) enamel solubility in the patient's saliva.

The first development of tests of this type we owe, as far as I know, to the late Dr. Rodriguez. This work was taken up, extended and modified by many successors, including Hadley, Jay and Snyder; Rosebury; Blayney and his associates; Morse and his associates; Fosdick, Hansen and Epple, and Schainis. I shall not undertake to describe the technic of these tests. By most competent students of the problem, they are still considered to be in the "experimental" stage. But do not think that this saying in any way detracts from the value of these tests. A very real part of their clinical significance lies in the fact that they or their modifications or their successors promise to put in our hands instruments of definite and reliable prognosis, and, as all advocates of preparedness strive to make us aware, forewarned is forearmed.

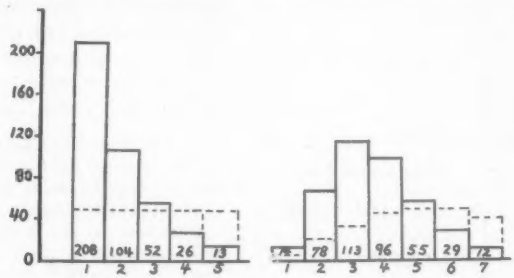

Figure 1.

DENTAL PULP

The literature contains many references to the presence of bacteria in the living dental pulp. This condition is not surprising when there is a large cavity, but it has also been reported in the case of teeth with intact enamel, especially if the periodontal tissues showed rather marked infection. These findings occasioned grave concern on the part of certain clinicians, who wanted to know their significance, particularly whether such pulps could function as foci of infection. (Thoma 1928, 1929.) In every case, however, the cultures had been taken from extracted teeth. The possibility obviously existed that the bacteria had been introduced at the time of extraction and by the act of extraction, and that the pulps had been sterile while the teeth had been *in situ*. As far as I know, Dr. Rickert was the first to state this possibility explicitly.

To settle this point, in collaboration with Dr. Gunter and a number of students, I began to culture living pulps before extraction. To date, we have in this way examined the pulps of thirty-five teeth, and, in all thirty-five instances, the cultures showed no growth. In fact, I would have been a little better pleased if the results had not been so uniformly negative. These findings are corroboratory of the findings and inferences of Fish and McLean and of Ruth Tunnicliff. All things considered, we can, I believe, feel reasonably sure that most vital pulps, in the absence of deep caries, do not harbor viable bacteria.

PERIAPICAL INFECTION

The probability that the apparent presence of bacteria in the vital pulp in many instances represented really an artefact, *i.e.*, a result of the technic used, has been extended *mutatis mutandis* by Fish (1939) to the periapical and periodontal tissues. Whether or not later studies substantiate these views, Fish has done service in bringing about a more critical and sceptical attitude toward reports of positive cultures from the apical region of extracted teeth. In most instances, it is my

present belief, such cultures are, at best, untrustworthy, if not actually misleading. If, for any reason, a culture of the periapical region is desired, it should be taken while the tooth is still *in situ*, either through the root-canal or through the external alveolar plate. If we choose the latter approach, (1) we can make use of some modification of the Coriell trocar (Grossman, 1932); or (2) we may expose the apex as if we were to amputate a root. These technics are applicable only to pulpless teeth, and neither should be undertaken without roentgenograms of the field in question. The most serious

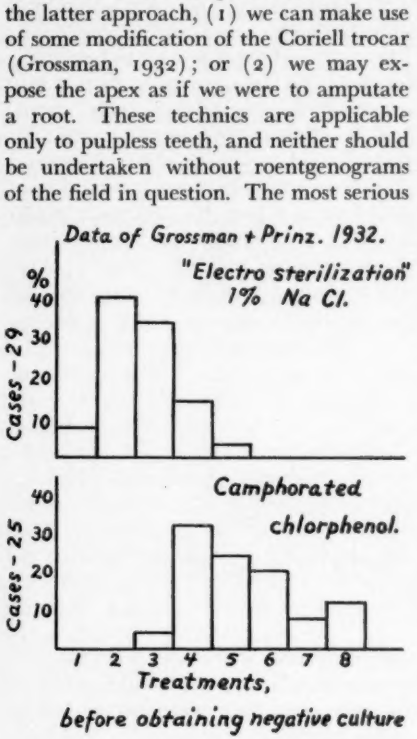

Figure 2.

limitation to the trocar method is the fact that negative cultures obtained thereby are unusually unreliable.

Probably, bacteriologic methods find their widest application in clinical dentistry in the management of the pulpless tooth. If the pulpless tooth is to be conservatively treated, treatment should be controlled bacteriologically. At first, I was led to this conclusion by the following argument based on general principles: 1. Periapical infection is at times responsible for more or less serious extraoral disease. 2. Such effects arise from bacteria present in the periapical tissues. 3. All methods of treating periapical infection, in spite of wide variety and diversity, involve, as an indispensable factor, an antibacterial action.[1]

4. The only methods which throw any light at all upon the sterility or nonsterility of the periapical tissues are bacteriologic.[2]

If the foregoing argument is cogent, it necessarily follows that before we fill the canals, we must make an intelligent effort to learn whether our method of treatment has succeeded in one of its chief objectives; *viz.*, the elimination of periapical infection.

Evidence bearing specifically on this requirement has come to light, and it is no longer necessary to rest solely on general principles. For the years 1928-1931, we have records of the results of cultures in 416 cases which were treated conservatively in the clinic of the dental

1. A pulpless tooth is tolerated in the mouth on the assumption that the periapical tissues can be rendered sterile without being so damaged that they constitute a *locus minoris resistentiae*, or on the assumption that the bacteria were, if absolute sterility was unnecessary, reduced to the minimum with which the vital resistance of the periapical tissues can deal. In the absence of any evidence in support of the second assumption, we feel that, at least for the present, we must, out of respect for the health of the patient, require the extraction or possibly apicoectomy of all pulpless teeth which persistently yield positive cultures.

2. The following quotation from Bulleid is pertinent:

"It is interesting to note that in none of the cases of chronic apical osteitis investigated were proteolytic organisms of the *mesentericus, proteus* or *subtilis* groups discovered. This shows how futile and unsafe is the method of smelling root canal dressings in order to determine sterility.

"Similarly, the x-rays afford no reliable information regarding the bacteriologic condition of the apical and periapical tissues. Negative roentgenograms are not proof of the absence of bacteria; and positive roentgenograms do not invariably mean the presence of bacteria." (Sommer and Crowley, 1939.)

school of the University of Pennsylvania. If a positive or negative result, growth or no growth of bacteria, was merely a matter of chance, after the first treatment one-half of the cases would yield a negative result. This would leave 208 cases, still positive, to be subjected to the second treatment. If mere chance still determined the result, after the second treatment one-half of these 208 cases, or 104 cases, would yield a negative result, leaving 104 positive cases to undergo the third treatment, and so on. This is a simple heads-or-tails or fifty-fifty proposition. These hypothetical results are given in the graph at the left of Figure 1.

leveling-off and dropping of the percentage line at the extreme right of this graph might be discussed, but their consideration had best be postponed until we have a larger number of cases in which positive cultures have been obtained after five, six or seven treatments.

A comparison of the two graphs makes it clear that the percentages of positive or negative cultures obtained after successive treatments do not correspond with the percentages to be expected if the securing of a positive or negative culture were a matter of mere chance. This finding is interpreted to mean that the result of the cultures does in some way reflect

NUMBER OF TREATMENTS GIVEN BEFORE OBTAINING A NEGATIVE CULTURE

	Camphorated Chlorphenol Treatment		"Electrosterilization" with 1% Aqueous Sodium Chloride	
Number of Treatments	Number of Cases	Percentage of Cases	Number of Cases	Percentage of Cases
1	0	0	2	7
2	0	0	12	41
3	1	4	10	34
4	8	32	4	14
5	6	24	1	3
6	5	20	0	0
7	2	8	0	0
8	3	12	0	0
	25	100	29	99

The dotted line represents the percentage and is obtained by dividing the number of cases becoming negative after a given treatment by the total number of cases undergoing that treatment. In the graph at the left, where mere chance is supposed to rule, the dotted percentage line continues straight across at the 50 per cent level.

A glance at the graph at the right of the figure shows that the results actually obtained do not correspond with those to be expected from mere chance. After the first treatment, fourteen instead of 208 became negative. The percentage of cases becoming negative increases with each successive treatment, as if the effect of the treatment were cumulative. The

the bacteriologic condition of the root canal or of the periapical tissues.

In the immediately preceding paragraphs, the data have been gathered by reculturing teeth which had already yielded a positive culture. Analogous results are obtained when teeth which yield a negative culture are recultured. Between the two consecutive cultures, no treatment was given. Only a sterile, nonmedicated paper point was sealed in the canal. For example, 156 teeth which had given a negative culture were recultured. Of these, forty (26 per cent) yielded a positive culture; whereas, if pure chance determined whether a positive or a negative culture would be obtained, approximately 50 per cent of the teeth recultured

would have yielded a positive result.

In a series in which an antiseptic dressing had been left in the canal after a negative culture had been obtained, reculture yielded a result still farther from what would be expected from pure chance. In only two (8 per cent) of twenty-six cases was growth obtained in the culture which was taken next after a negative culture. (Grossman, 1933.)

Other pertinent data, pointing in the same direction, are furnished by Grossman and Prinz (1932). In comparing the values of two methods of treating periapical infection, they assumed as their criterion the number of treatments needed to obtain a negative culture. The fewer treatments needed, other things being equal, the better the method.[1] Let us turn to a consideration of the data in the accompanying table, and Figure 2. It is unnecessary to keep in mind the procedures actually used. If there was no difference between them in the rapidity with which the cultures became negative, we might assume either (1) that they were equally effective in bringing about a state in which it was impossible by the bacteriologic technic employed to secure viable bacteria, or (2) that the bacteriologic technic employed was inadequate to reveal a difference. Now, there is at least some clinical evidence that these two procedures are not equally effective in combating periapical infection. In fact, clinical evidence tends to give the advantage to "electrosterilization"; an observation that is consonant with the findings summarized in the table and in Figure 2. Consequently, I am going to assume that the two procedures differ in effectiveness and that the bacteriologic technic employed really does distinguish between them. In other words, here again the results of the cultures do in some way reflect the bacteriologic condition of the root-canal or of the periapical tissues.

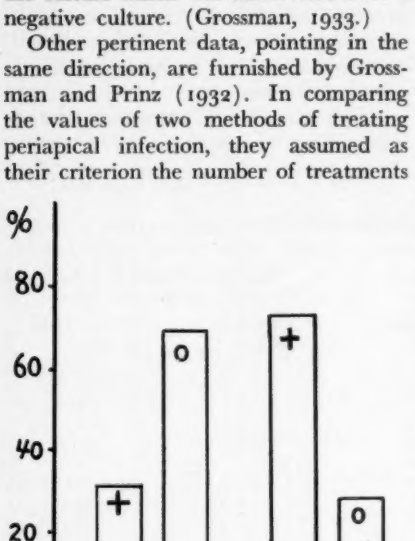

Figure 3.

The clinical value of bacteriologically controlling the treatment of periapical infection is also shown by an analysis of data furnished by Rhein, Krasnow and Gies. Rhein took cultures before filling the canals, but sometimes filled them in spite of a positive culture. Figure 3 shows the results obtained in cases not previously treated. The cases designated "successful" are those in which the results were judged by Rhein to be clinically and roentgenographically successful; the cases designated "unsuccessful" are those wherein he judged the results to be clinically and roentgenographically unsuccessful. In seventy-three per cent of the "unsuccessful" cases, the canals had been filled in spite of a positive culture; in 31 per cent of the "successful" cases, the canals had been filled in spite of a positive culture.

Other criteria than the clinical or the

1. We are now only incidentally interested in their problem as they saw it, though we are tempted to point out parenthetically (1) that to obtain negative cultures, it was on the average necessary to give more than twice as many treatments when camphorated chlorphenol was applied topically as were necessary when "electrosterilization" with 1 per cent sodium chloride was used; and (2) that these very methods which are available for routinely checking the treatment of periapical infection also lend themselves as criteria for judging the relative merits of competing therapeutic procedures.

roentgenographic should be used in judging the success of "root-canal" treatment; and the number of "unsuccessful" cases reported by Rhein is too small for statistical purposes. This point should be further investigated. Nevertheless, taking such data as are at present available, it appears that a clinically and roentgenographically satisfactory result is much more probable when a canal is filled only after a negative culture than when the canal is filled in spite of a positive culture.

If it be assumed that most dentists would rather not, knowingly or unknowingly, seal bacteria (usually streptococci) in the apical or periapical region with a filling, the question is nevertheless in order: Is there really any need for a bacteriologic check before filling the canals? Does this check reveal the persistence of bacteria in any appreciable proportion of cases which otherwise, on the basis of clinical and x-ray findings alone, would be considered ready for final filling? In a series of 200 consecutive cases which had reached the stage where ordinarily it would be thought safe to fill the canals, fifty-two (*i.e.*, 26 per cent) yielded a positive culture. (MacPhee, 1936.) In another series, of 150 cases, in which the work had been done by a variety of operators, presumably using several different "root-canal" technics, the showing was still poorer. The bacteriologic test confirmed the clinician's opinion in 58 per cent of the cases. Grossly, this is only slightly better than the 50-50 chance of a pure guess; and, considering the number of cases, it is unlikely that the difference between the 58:42 ratio and the 50:50 ratio is statistically significant. (Grossman, 1936.) In a third series of 258 teeth ("root-canal" clinic of dental school, University of Pennsylvania, 1938-1939), the clinician's opinion that the canal was ready for filling was confirmed by a negative culture in 60 per cent of the cases.

Even though the bacteriologic control of "root-canal" work had no intrinsic advantage, it might nevertheless justify itself in that it puts the operator "on the spot": if he fails to adhere rigorously to elementary principles of surgical technic, bacteria will show up in his cultures to shame him if he has any sense of shame.

Let me at this point summarize the reasons which seem to me to justify the bacteriologic control of the conservative treatment of pulpless teeth.

I. The *a priori* argument.

II. Special evidence.

A. The ratio of positive and negative cultures, which is not what would be expected by pure chance:

1. When teeth that have given a positive culture (growth present) are recultured.

2. When teeth that have given a negative culture are recultured.

3. When two methods of treatment are compared in respect to the number of treatments given before obtaining a negative culture.

B. The comparison between teeth filled only after a negative culture and teeth filled in spite of a positive culture, in respect to subsequent, clinical and roentgenologic history.

From the data classed as II.A.1, 2 and 3, the inference is drawn that, since the result of the culture is not what would be expected if the result were determined by pure chance, the result of the culture does in some way reflect the bacteriologic condition of the canal or periapical tissues. The type of evidence, however, that is most convincing is that classed as II.B. above, in the sense that the proof of the pudding is in the eating. The subsequent history of teeth filled after positive and negative cultures should be followed and compared, not only in respect to the criteria to which Rhein limited himself (clinical and roentgenologic), but also in respect to all pertinent criteria. (Appleton, 1939.)

Negative cultures have been reported from the apical and periapical region of extracted pulpless teeth. (Mela, 1934;

Stein, 1935.) Unless we are ready to "explain" all these negative cultures as due to errors in technic, we shall have to admit that, in a certain percentage of pulpless teeth, the apical and periapical tissues are virtually sterile. In view of the already mentioned fact that it is almost impossible to avoid contamination of the dental tissues during extraction, the exact percentage of pulpless teeth with virtually sterile apical and periapical tissues is probably higher than the figures actually given in previous reports. Even with liberal allowance for false positives, the percentage is not high enough to justify the practitioner in adopting a *laissez faire* or "let-well-enough-alone" policy. It is still good practice, except for deliberately experimental purposes, to open and fill the canals of all pulpless teeth which are not to be extracted. In this connection, it is well to remember that the x-rays give no reliable information regarding the bacteriologic condition of the periapical region. In the group of cases with which we are now concerned, it would seem advisable to make a bacteriologic examination as soon as access has been gained to the apical region. Pending the report on the culture and in case no clinical contra-indications exist, a sterile, non-medicated dressing should be sealed in the canal. If the culture proves to be negative, if the smear from the dressing gives no evidence of bacterial infection and if no clinical contraindications have arisen, it will be justifiable to proceed directly to the filling of the canal. In such cases, when uncertainty exists concerning the bacteriologic condition of the apical and periapical tissues, bacteriologic examination will help the operator to avoid the dangers of overmedication.

The frequency with which positive cultures are obtained from the apical and periapical tissues of teeth with clinically normal pulps, and the significance of these positive cultures, will doubtless affect the significance which is attached to positive cultures from the apical and periapical tissues of pulpless teeth. However, until a satisfactory volume of data obtained from culturing teeth with "normal" pulps before extraction is available, it will be futile to study the implications of positive cultures from such teeth. Pending the collection of these data, we "play safe" with the health of our patients if we exact a negative culture before we fill the root canal.

Although this is not, I believe, the occasion to go into the technical details of bacteriologic control of the conservative treatment of pulpless teeth, I should like to consider a few technical points. (Appleton, 1933.) Before beginning the cultural examination, I advocate a direct microscopic examination of a stained smear which has been made with a dressing that has been sealed in the canal. If the smear indicates the persistence of bacteria, one is saved the trouble of taking a culture and, what is more important, one can immediately continue treatment or reconsider what had best be done.

The making, staining and examination of the smear, which occupy but a few moments, can, and should, be carried out while the patient is still in the chair. The technic is elementary. If, for any reason, a cultural examination is not to be made, the "smear" examination, though less delicate, is advocated as the next best thing. In an appreciable number of cases clinically considered ready for filling, it will reveal the persistence of bacteria.

As the bacteria under suspicion in oral focal infection are streptococci, and as these streptococci, with few or no exceptions, have the faculty of developing in the presence of atmospheric oxygen, the medium chosen should be one in which streptococci grow well, and inoculated cultures may be kept routinely under aerobic conditions.

Before filling the canal, it is well to require two consecutive negative cultures.

This is advised because an appreciable number of teeth which have yielded one negative culture will, on reculture, give a positive result (26 per cent of 156). Analogous results, it is well to recall, are obtained in throat or stool cultures taken before diphtheria or typhoid patients, respectively, are discharged.

I have always used a liquid medium for the primary culture, in the hope that any trace of medicament that might have been transferred would be more effectively diluted than would be the case in a solid medium. After incubation, I examine the culture microscopically to determine the presence or absence of bacteria. I do not rely on the naked-eye appearance of turbidity. In order to avoid this microscopic examination, Prader (1937) recommended the addition of an indicator (bromcresol purple) to the medium. A color change, detectable by mere naked-eye inspection after incubation, would indicate the presence of bacteria. Although the use of such an indicator medium is preferable to no bacteriologic control at all, the indicator medium is a less delicate test of the presence of bacteria than the method that we have habitually used. In the same 143 cases of pulpless teeth, the indicator medium yielded 28 per cent positive cultures, while the same medium without the indicator yielded 42 per cent positive cultures. (Appleton, 1938.)

In root canal work, bacteriologic methods are uncalled for until that stage is reached where the operator, on the basis of his clinical experience, would otherwise fill the canal. Bacteriologic methods are then to be employed because they alone can give us reliable information regarding a possible failure to eliminate periapical infection. In interpreting the result of bacteriologic examination, it is necessary that its limitations be kept in mind. It never of itself, I believe, authorizes the filling of the canal. Its usefulness lies exclusively in revealing when the canal is not yet ready for filling. Bacteriologic methods in this connection are useful only in that they exert a veto power. This negative value is, of course, a shortcoming, but the importance of a clear-cut indication as to when not to fill a canal will appear the greater according to the sincerity, intelligence and carefulness of the operator.

FOCAL INFECTION

Many attempts have been made to determine the primary focus when symptoms of focal infection are present. Blood counts and urinalyses, although they may reveal the presence of infection in the body, fail to indicate a particular focus. It has been proposed by de Niord that the uric acid content of the blood be taken as an index of focal infection; but hyperuricemia is present in so many conditions that, even granting its possible significance, its range of application is narrow.

Isolated attempts have been made to employ the several serologic tests (agglutinin, precipitin, complement fixation, opsonic, pathogen-selective, etc.) and cutaneous tests for hypersensitivity in the solution of this problem. The organisms or "antigens" employed would be autogenous, isolated from one or another of several suspected foci. In some instances, following Rosenow's ideas, the isolated bacteria have been injected intravenously into rabbits to determine whether a specific tissue affinity, corresponding with the patient's metastatic lesion, would be manifested.

More recently (Gutzeit), it has been reported that, while short wave irradiation of healthy teeth with living pulps does not cause an acceleration of the sedimentation rate of erythrocytes, the short wave irradiation of some teeth with diseased or dead pulps does have that result. However, in some roentgenologically positive teeth, short wave irradiation does not result in an acceleration of the sedimentation rate. From these observations, it has been inferred that those diseased teeth, the short wave irradiation

of which results in an acceleration of the sedimentation rate, are exerting a detrimental effect. There are two possible explanations of the absence of an acceleration of the sedimentation rate after short wave irradiation: (1) the tooth in question may contain no toxic substances and may have no connection with the lymph and blood vessels of the general organism or (2) the irradiation technic may be faulty. Extraction of teeth giving a positive reaction is not always followed by improvement in the general condition. These observations and the inferences therefrom, while interesting, will have to be repeatedly and independently confirmed before we can rely on this method for separating the innocuous from the harmful among our pulpless teeth. In fact, evidence of the limitations and unreliability of this short-wave, sedimentation, provocative test has already been forthcoming. (Kuehn, 1938; Pfankuch & Karpf, 1939.)

Up to the present, no method of general applicability has been evolved. The clinician and the patient want to know whether a low-grade, chronic infection is contributing significantly to the patient's condition. They want to know the site of that infection, and the possible effect upon the particular condition of elimination of the infection. These questions cannot as yet be definitely answered.

There is one thing more to which I should call attention. Though not a clinical laboratory method, it has an obvious clinical bearing on focal infection. In recent years, there has been growing recognition of the fact that bacteria on occasion escape from periapical or periodontal tissues into the blood stream. The occasion for this escape includes chewing, scaling and extraction. Usually, these cases of bacteriemia are transient, and apparently the patient is none the worse. If, however, the patient has a damaged heart valve and the bacteria localize on these valves, bacterial endocarditis may follow. As a prophylactic measure, the administration of sulfanilamide or sulfapyridine has been recommended for patients whose history leads one to suspect damage of the heart valves. (Hussey, 1937; Major and Leger, 1938; Ellis, 1938; *J.A.M.A.*, 113:703, August 19, 1939; Spink and Crago, 1939.) This precaution would seem to be especially called for when it is necessary to operate in a badly infected field or there is reason to expect considerable surgical trauma; and it might not be amiss to take this precaution when it might be thought desirable to scale pyorrheic teeth.

LESIONS OF THE ORAL MUCOSA, INCLUDING THE PERIODONTAL TISSUES

If there is reason to suspect malignancy, diabetes mellitus, blood dyscrasia, avitaminosis, allergy, syphilis, tuberculosis, actinomycosis, thrush or some similar, less common condition, the general practitioner should refer the patient to some one whose opportunities and whose experiences have brought some familiarity with the less common lesions of the mouth. At the present time, I believe that most of the lesions of the soft tissues of the mouth and of the periodontal structures are not primarily caused by bacteria or other micro-organisms. The bacteria are there, often in greatly increased numbers, and they may aggravate and accelerate the lesion. They may be responsible for the major part of the extra-oral or systemic effects; and antibacterial measures may be justified, but they do not get to the root of the trouble. The bacteria in most of these instances are merely opportunists. Rational therapy will not be satisfied by combating them, but must go far beyond that to attack or correct the underlying conditions. Antibacterial therapy, in most of these instances, is merely temporizing.

Direct, microscopic examination of stained smears in general gives us more information than does cultural examination, when the oral mucosa or periodontal tissues are involved. As much as

possible of the superficial débris is to be removed, then the material to be examined is collected from as deep in the lesion as is possible without bleeding. The material is to be collected on a toothpick, a dental instrument that will conveniently reach the desired spot or a 24-gage nicochrome bacteriologic needle the tip of which has been hammered out in the form of a spatula. Such a needle can be readily bent to reach any desired area in the mouth. The thin, spatula-like tip can be introduced into pockets and between teeth; and its sterilization in the flame is easy and rapid.

The material collected should be spread in a thin, even layer as widely as possible over the surface of a clean glass slide. Bon Ami is excellent for cleaning these slides. A number of smears should be prepared from each case. It is often desirable to check what is found in one area of the mouth with what is found in other areas; and what is found in one smear often suggests other staining technics to be applied to other smears. The film, after air-drying, is fixed by passing through a flame in the usual way. It is then ready for staining.

Any of the ordinary bacteriologic stains may be used. I never have found another stain for a preliminary survey of the mouth flora which I have liked so well as the one introduced in 1915 by Bass and Johns in their study of the mouth amoebae (Appleton, 1933, p. 590): carbol-fuchsin washed off at once with tap-water, followed by methylene blue until the color of the film is on the blue side of purple. When this tint is reached, the film is washed free of the dye in tap-water, blotted dry and examined with an oil-immersion lens.

Films prepared in this way may be used for diagnosis, for the control of treatment and for determining when to discharge the patient, especially in those conditions characterized by or associated with Vincent's organisms. In interpreting these films, it is highly important to do so only in connection with the clinical findings. This reservation holds for clinical tests in general. The presence of diphtheria bacilli in the body does not mean diphtheria. The clinical findings are at least as important as the laboratory findings.

The finding of large numbers of spirochetes or pus cells in mouth smears almost always means that something is wrong. It may be unimportant, if not repeated too often or allowed to continue too long; *e.g.*, an overhanging margin of a filling, fillings that encourage food-packing between teeth, poor gingival adaptation of crowns, irregularity in the position of teeth permitting the impaction of food upon the gum, flaps of tissue overhanging erupting teeth, particularly third molars. There is no doubt that a large percentage of adults constantly harbor large numbers of Vincent's organisms in their mouths; and if "normal" is taken to mean "average" or "ordinary," the finding of these organisms in the adult human mouth is normal. That does not mean that this finding represents a harmless condition, to be accepted with indifference. After examining smears from the mouths of dental hygienists and of dental students through many years, I am thoroughly convinced that large numbers of spirochetes are indicative of something pathologic, something which needs attention. If nothing can be done about it, the fact should at least be faced.

Frequently, in Vincent's infection, though the mucosa approximates the normal to the naked eye, Vincent's organisms are present in large numbers. This may account for at least some instances of the tendency to recurrence which is characteristic of Vincent's disease. To avoid premature cessation of treatment, it is best, wherever feasible, to continue treatment until mouth smears have become negative for Vincent's organisms, and to include a microscopic examination of mouth smears whenever the patient presents himself for his peri-

odic check-up, even though the mucosa seems healthy.

The danger of extracting teeth or of otherwise surgically wounding the mucosa during an attack of Vincent's infection is generally realized. However, it is desirable to go a step farther. Even though the mucosa is normal to the eye, it is wise, as a preliminary measure, to examine the field of operation for Vincent's organisms. If they are found, preoperative anti-Vincent's treatment should be instituted. This precaution is particularly indicated where there is apt to be much surgical trauma, as in difficult extractions, especially in the removal of unerupted or impacted third molars. The third molar region is a favorite nidus for these organisms, even in the absence of gross inflammation. If the organisms are there, they may invade the tissues whose resistance has been lowered by trauma. Wright has reported a more rapid healing of the tissues preoperatively receiving anti-Vincent's treatment, after the removal of impacted teeth.

Material from the oral mucosa may be examined by dark-field illumination. The picture which one thus obtains, especially if the mouth has been neglected or if disease actually is present, is striking. It arrests the attention of students and practitioners and holds the attention for a much longer time than any mere stained smear. One realizes more vividly than in any other way the enormous numbers of the "animals in the scurf of a man's teeth" and the enormous, restless activity of these "animals." However, as an aid in clinical diagnosis or in the clinical management of oral diseases, dark-field examination is in my estimation far less useful than the examination of stained smears. There is no appreciable difference in the time needed to prepare for the two examinations. The smears can be studied and restudied at one's leisure, and they may be kept and filed as a relatively permanent record.

The frequent presence in the human oral cavity of spirochetes *(T. mucosum, T. microdentium)* which cannot with certainty be distinguished from *T. pallidum* prevents us from using the dark-field examination as an aid in diagnosis of the primary or secondary lesions of syphilis in the mouth.

SUMMARY

My chief objective has been to call attention to certain bacteriologic methods and certain modes of thought that have been applied more or less profitably to the solution of problems arising in the ordinary course of general practice.

We have seen that certain tests, in themselves or in their successors, hold out promise (1) of serving as a criterion of the efficacy of measures offered for the control of dental caries; (2) of indicating the degree of intensity of the carious process, and (3) of foretelling carious activity, even while clinically all seems quiet.

In connection with periapical infection, I have called attention to simple, economical and quickly applied bacteriologic methods which have been used (1) to compare the efficacy of methods proposed for the conservative treatment of pulpless teeth; (2) to determine whether a symptomless pulpless tooth needs antiseptic treatment, and (3) to determine whether viable bacteria survive in apical and periapical tissues, in an effort to determine whether there is need for continuing antiseptic treatment.

In cases of gingivitis, stomatitis and "pyorrhea alveolaris," the direct microscopic examination of stained smears and, to a much lesser extent, cultures have been used (1) in diagnosis, (2) for control of treatment, (3) in deciding when to discharge the patient; (4) at periodic oral health examinations, to seek for evidence of recurrence, and (5) to obtain evidence of the existence of subclinical infection or infestation of the oral mucosa, which should be taken care of before dental extraction or similar operations.

An outline of the reasons for using

certain bacteriologic tests in connection with some of the commoner problems of general practice, together with the rationale of these tests, and their indications, limitations and interpretation has been thought more important than an attempt to furnish a working knowledge of the technics involved. Technics are indispensable, but they vary in detail from place to place; they will be modified as time goes on, and they are difficult to learn except from direct laboratory contact. The utility of these tests has been emphasized, in the belief that once this activity has been recognized, the acquirement of technic can be left to one's initiative.

Two of the suggestions given may have immediate clinical applicability. The first relates to sterilization of freshly cut dentin surfaces before insertion of the filling. The second concerns the prophylactic administration of sulfanilamide or sulfapyridine before extensive, traumatizing oral surgical operation or the manipulation of pyorrheic teeth in patients with a history of valvular disease of the heart.

You will have noted gaps in our knowledge and assumptions made with no other justification than that we had either to make them or to do nothing. You will have noted the small number of instances wherein bacteriologic methods can be applied to common clinical dental problems with the probability that the findings will have a direct bearing upon the management of the case in hand. This does not mean that bacteriology has been without influence in the evolution of dentistry. The revolution occasioned by the development of the germ theory of disease in all its ramifications influenced dentistry no less than it did the other healing arts. The discovery in rapid succession of the direct causes of many diseases was followed immediately and often dramatically by the effective control of these diseases. By demonstration of the practicability of disease prevention, the ideal of prevention was greatly encouraged, and it came to be increasingly accepted as the chief directive force, both in medicine and in dentistry. Our ambition should go one step farther. Instead of being satisfied merely with the prevention of disease, we should aim at no less than the full and balanced realization of the potentialities of the germ plasm of the individual and of the race.

But the gaps, uncertainties and inadequacies in our knowledge of the relation of bacteria to oral health and disease clearly and urgently point out the need for further study. Perhaps too many of our efforts have been, and still are, put forth to solve a particular clinical problem. Perhaps we have been in too much of a hurry. Benefiting by the experience of older arts and sciences, dentistry might well devote more of its time to studying the flora and fauna of our mouths and the interrelations existing among these animals and plants and ourselves, in the spirit of pure science. I admit that we need to attack the clinical problems, including the means of disease prevention. But there are usually more ways than one to get to a given place, and sometimes the longest way round is the shortest way home.

BIBLIOGRAPHY

APPLETON, J. L. T.: Bacterial Infection with Special Reference to Dental Practice. Philadelphia: Lea & Febiger, 1933; chap. 28, p. 527.

Idem: Schweiz. Monat. f. Zahnheilk., 48: 1083, 1938.

Idem: J. Ohio D. Soc., 13:21, February 1939.

BLAYNEY, J. R., *et al.: J. D. Res.*, 15:326, September 1936.

Idem: J. D. Res., 18:260, June 1939.

ELLIS, G. R.: *Lancet*, 2:1521, December 31, 1938.

FISH, E. W., and MACLEAN, I.: *Brit. D. J.*, 61:336-362, September 1936.

FISH, E. W.: Bone Infection, J.A.D.A., 26: 691-712, May 1939.

FOSDICK, L. S.; HANSEN, H. L., and EPPLE, CHARLOTTE: Enamel Decalcification by Mouth Organisms and Dental Caries: Suggested Test for Caries Susceptibility. J.A.D.A., 24:1275-1280, August 1937.

GROSSMAN, L. I., and PRINZ, HERMANN: *D. Cosmos*, 74:324, April 1932.

GROSSMAN, L. I.: *J. D. Res.*, 13:257, August 1933.

Idem: J. D. Res., 15:364, September 1936.

GUNTER, J. H., *et al.: J. D. Res.*, 16:310, August 1937.

GUTZEIT, K.: *München. med. Wchnschr.*, 84:961, June 18, 1937; 85:164, February 4, 1938.

HADLEY, FAITH P.: *J. D. Res.*, 13:415, October 1933.

HUSSEY: *M. Ann. Dist. Columbia*, 6:275, 1927.

KUEHN: *Zahnaerztl. Rund.*, 47:1659, October 2, 1938.

MACPHEE, G. G.: *Brit. D. J.*, 60:119-125, February 1, 1936.

MAJOR, R. H., and LEGER, L. H.: *J.A.M.A.*, 111:1919, November 19, 1938.

MELA, B.: *Zahnaerztl. Rund.*, 43, 1934.

MORSE, F. W., *et al.: J. D. Res.*, 15:322, September 1936.

PFANKUCH, K., and KARPF, H.: *Klin. Wchnschr.*, 18:884-885, 1939.

PRADER, F.: *Schweiz. Monat. f. Zahnheilk.*, 47:35-59, 1937.

PRICE, P. B.: *J. Infect. Dis.*, 63:301-318, November-December 1938.

SCHAINIS, M. E.: *J. D. Res.*, 18:285, June 1939.

SNYDER, M. L.: *J. D. Res.*, 18:242, June 1939.

SOMMER, R. F., and CROWLEY, MARY C.: *J. D. Res.*, 18:286, June 1939.

SPINK, W. W., and CRAGO, F. H.: *Arch. Int. Med.*, 64:228, August 1939.

STEIN, GEORG: *J. D. Res.*, 15:199, June-August 1935.

THOMA, K. H.: *J. D. Res.*, 8:529, August 1928; 9:447, 486, August 1929.

TUNNICLIFF, RUTH, and HAMMOND, CAROLYN: Presence of Bacteria in Pulps of Intact Teeth. J.A.D.A., 24:1663-1666, October 1937.

Idem: Smooth and Rough Greening Streptococci in Pulps of Intact and Carious Teeth and in Carious Dentin. J.A.D.A., 25:1046-1052, July 1938.

WRIGHT, W. T.: Vincent's Infection. J.A.D.A., 17:1294, July 1930.

DENTAL PHASES OF BRONCHOSCOPY

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THE similarity of pathogenic organisms found in the lungs in pulmonary disease and in the mouth around carious teeth is not an accidental finding. As the funnel-shaped hypopharynx and larynx form a direct pathway from the mouth to the tracheobronchial tree, infected material from teeth, as well as the teeth themselves, may drop downward into the lungs, to produce severe pulmonary disease. The normal protective mechanisms, however, are extremely powerful and are a surprisingly efficient barrier. Under normal conditions, the slightest irritation of the extremely sensitive laryngeal or tracheal mucosa initiates a series of reactions which may be designated as a first line of defense. These are the spastic closure of the glottis itself and the all-important cough. A second defense mechanism is the ever-present rhythmic action of the cilia of the tracheobronchial mucosa, which constantly sweep bacteria-containing mucus back into the mouth.

During certain pathologic states, such as alcoholic intoxication, laryngeal cord paralysis, anesthesia or even normal sleep, these defenses may be lost, and infectious material can then pass directly into the trachea without resistance. This is illustrated most graphically when teeth are aspirated into the tracheobronchial tree. Therefore, a discussion of the etiology, symptoms, diagnosis and treat-

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ment of such foreign bodies will, in a large measure, stress their importance and also serve as a groundwork for a discussion of the relationship between pulmonary suppuration and dental infection.

DENTAL OBJECTS AS FOREIGN BODIES IN THE TRACHEOBRONCHIAL TREE

Teeth, dental appliances and instruments may suddenly become lost in the air or food passages, to constitute a serious diagnostic and therapeutic problem.

Etiology.—In analyzing statistics on the frequency of such accidents, one is immediately impressed by their extreme rarity in comparison with the great number of patients, including struggling children and uncooperative adults, on whom dental procedures are performed daily. As Jackson and Jackson[1] state, "It is a great tribute to dental skill that accidents are so rare." These authors report thirty-nine cases, or 1.2 per cent, of a series of 3,266 cases of foreign bodies lodged in the air and food passages which could be classed as dental accidents. In our own series of 162 cases of foreign bodies seen in the past three years, nine of the foreign bodies in the lungs and one in the vallecula were dental objects. The four in the lungs, or 2.5 per cent of the entire series, were associated with a dental procedure. In three of these four cases, the procedure was extraction. In the fourth case, an inlay was lost, being flipped out of its bed prior to being cemented in place. It is extremely significant that general anesthesia was used in each of the three cases in which the object was lost during extraction. While this is obviously too small a series from which to draw general conclusions, the Jacksons state, in discussing their large series, that "nitrous oxide was being used in almost all cases in which a tooth had been inspirated during an extraction." Hedblom,[2] in a report of fifty-five cases of dental foreign bodies, states that, in twenty-seven instances, the accident occurred during the extraction of teeth under general anesthesia; and, in four, the foreign bodies were inspired during dental operation without anesthesia. The procedure in the remaining cases is not mentioned.

Certain diagnostic principles are of the utmost aid in determining the presence of a foreign body. The history is of extreme importance and may in itself be sufficiently positive to afford a diagnosis in spite of a lack of symptoms and with negative physical and roentgen-ray findings. The history is obviously definite if the patient states that he choked on something, or if a mother states her child lost a tooth during anesthesia for some operation such as a tonsillectomy. With such a positive history, no effort should be spared to locate the foreign body. Physical examination and complete x-ray studies including the nose, nasopharynx, neck, chest and abdomen to the ischial tuberosities should be made, the operator bearing in mind that the intruder may be anywhere in the gastrointestinal or respiratory tract. A negative history in a doubtful case, on the other hand, is valueless and may be very misleading. The patient may be too young to give an accurate history or, in older persons, the original accident may have been entirely forgotten.

Symptomatology.—The symptoms may be divided into three periods. As the foreign body strikes the posterior pharyngeal wall, the larynx, or the tracheal mucosa, the initial symptoms are usually very severe and distressing. The patient chokes, coughs, gags and wheezes, and may become dyspneic or cyanotic. These initial symptoms may last for a few minutes or a few hours, and may gradually subside in spite of the fact that the foreign body may still be in the trachea or a bronchus. Frequently, during this stage, the patient can definitely locate the object if it lodges high in the air or food passages, but his efforts to locate it in the deeper structures are often futile and confusing. Pain and soreness in the chest are occasional early complaints. It is ex-

tremely important to note that in from 10 to 15 per cent of cases, the initial symptoms are entirely absent,[2] the presence of the foreign body being first demonstrated weeks or even months later, when symptoms of secondary infection manifest themselves.

A treacherous symptomless interval usually follows the violent initial coughing. This occurs after the foreign body has become fixed in the trachea or a bronchus and, being stationary, causes little or no irritation of the tracheal wall and consequently no cough. It is impossible to emphasize adequately this phase of the symptomatology. It is during this stage, which may last from a few hours to several months, that a positive foreign body history may be ignored and finally entirely forgotten by the time pulmonary suppuration develops.

The third stage in the symptomatology of a foreign body is obstruction of the bronchus or inflammation or erosion of the bronchial wall. If the foreign body has lodged in the bronchus, there may be sufficient swelling of the bronchial mucosa to completely occlude the airway to a single lobe or an entire lung. In such cases, the findings closely simulate pneumonia, and, not infrequently, this erroneous diagnosis is not corrected until an x-ray examination reveals the presence of a tooth or an inlay.

The symptoms in this stage need not be acute, however. They are frequently insidious in onset and may be identical to those of pulmonary tuberculosis; namely, a productive cough, occasional hemoptysis, night sweats and a loss in weight. Such symptoms may persist for a period of years, a chronic bronchiectasis developing, with the pale, pasty appearance of the patient, the clubbing of the fingers and the general debility associated with this disease.

Physical Findings.—It is beyond the scope of this paper to discuss the multitude of physical conditions which the presence of foreign bodies may cause. Three important points should be stressed, however. The first is that a wheeze heard at the open mouth or over the chest which does not disappear with coughing is an almost constant early sign. It indicates bronchial obstruction and frequently may be the only clue to the presence of the foreign body. We must remember that "all is not asthma that wheezes."[3] Second, an unexplained cough following dental work or any oral surgery similarly suggests the pressure of a foreign body. Third, if a patient develops pulmonary symptoms simulating pneumonia and following any dental work, a foreign body should be considered the etiologic factor until completely ruled out by the most complete x-ray study. Finally, in cases of unexplained pulmonary suppuration of unknown etiology, a foreign body should be considered in the differential diagnosis.

In all cases of foreign body or suspected foreign body, a complete roentgen examination should be made. This should be a study of the chest roentgenologically and not merely the interpretation of one film. The study should include the fluoroscopic examination of the chest; inspiration and expiration films in order to determine the possible shift of the heart produced by obstructive emphysema, and lateral films, to rule out the presence of a foreign body posterior to the liver or heart shadow. The lateral films are indispensable for accurately locating the foreign body in an anteroposterior plane, and their use is preferable to the stereoscopic examination. Besides the routine density film, an overexposed film should be made in suspicious cases, since even certain metallic foreign bodies cast little or no shadow with the usual x-ray technic.

Treatment.—Prophylactically, certain procedures are of extreme importance in preventing the aspiration of fragments of teeth, infected material or blood. Placement of a gauze pack in the oral-pharyngeal partition is the most common

procedure. Without question, use of such a pack has prevented many foreign body accidents. However, one must be certain that all fragments are out of the mouth before the pack is removed, and the pack must be arranged so that it can be quickly withdrawn when necessary. This is well expressed by Frank[4]:

> Having passed through the experience of an emergency tracheotomy, I can only say that one's ideas change to the extent of looking for safety above other considerations. If a pack is easily removable, then I am willing to sacrifice some of the advantages of a pack that might more completely block the open airway in the mouth.

The treatment of foreign bodies after they have been aspirated or swallowed into the air and food passages consists of only one method which is safe enough to be considered. The bronchoscope and esophagoscope may be used as specula, illuminating the tracheobronchial tree or esophagus to permit a safe approach to the foreign body. Appropriate forceps are then passed through the tube to grasp the object and remove it. Blind methods are inaccurate and frequently fatal. The problems of removing foreign bodies bronchoscopically are entirely mechanical. Therefore, it is necessary that a mechanical solution of the problem be known before an attempt is made at actual removal. The short delay required to plan the procedure is not dangerous; whereas hurried bronchoscopy, with inadequate instruments and insufficient preparation of the patient, may be fatal.

Before the subject of dental objects as foreign bodies in the lungs is left, mention of the medicolegal aspect seems important. In dealing with this problem, it is necessary to keep in mind at all times that, morally and legally, we are responsible for the health of the patient. The law is lenient in granting that accidents may happen when we treat patients; but it demands that ordinary care and precaution be exercised, and that there be no negligence. Consequently, when a patient is suspected of having aspirated a foreign body, he must be studied thoroughly roentgenologically and the proper steps be taken to remove the object after it has been located. Failure to do this, which may result in serious pulmonary damage, constitutes the negligence through which medicolegal suits are lost. One of the most important questions in regard to suspected accidents is what to tell the patient. Jackson[5] answers this in the following manner:

> If the dentist has lost an instrument or other object down in the patient's anatomy and fails to take proper steps to safeguard the patient's best interests, he becomes liable for negligence. His finer feelings as to saving his patient possible unnecessary anxiety will be misconstrued and held up mercilessly to ridicule by the patient's attorney. The first step, then, is to tell the patient of the suspected possibility and advise roentgen-ray examination. If the patient neglects this advice the responsibility is his; but the burden of proof that such advice was given will be on the dentist.

PULMONARY SUPPURATION

In any case of a pulmonary complication following dental extraction, one first considers aspiration of a foreign body. However, any operative procedure about the head and neck may be followed by one of a number of pulmonary complications of a suppurative nature in which a foreign body plays no demonstrable part. The two principal types are lung abscess and bronchiectasis.

The pathogenesis of these complications is a subject of great discussion in the medical literature, and without doubt no single explanation could be made for all cases. The aspiration of infected débris from the mouth during sleep seems a very obvious method of introduction of pathogenic organisms into the lower respiratory tract. Stern[6] assumed that the initial mechanism producing an abscess of the lung in many cases of abscess following operations in the mouth was the inhalation of minute particles of septic material,

particularly dental tartar, and not the organisms or secretions alone. Meyerson[7] demonstrated bronchoscopically the ease with which material in the mouth could be aspirated into the tracheobronchial tree during general anesthesia. However, with the presence of metastatic abscesses in other parts of the body besides the lungs, it is apparent that certain of the infections must be blood-borne. Finally, the dissemination of infection by way of the lymphatic system must be recognized. Lintz[8] stresses the fact that focal dental infection causes respiratory diseases not by means of aspiration, but through the circulation. He believes that aspiration and gravity are mechanisms which, while they may be present, have taken a secondary rôle, and the theory of infection by means of the circulation—the blood stream, and particularly the lymphatic stream—has usurped the dominant rôle.

A lung abscess (non-tuberculous) is a localized area of suppuration in pulmonary tissue. The presence of a fluid level depends on whether bronchial or external drainage has been established. The organisms are for the most part pyogenic and frequently are identical to those found in and around carious teeth. This is most readily demonstrated as regards the fusospirochetal group. Kline and Berger[9] stressed the association of infections of the gums, of the "Miller-Vincent" type, with pulmonary abscess and gangrene, and emphasized the danger of aspiration of infected débris from the mouth during general anesthesia. Penta[10] demonstrated that the virulence of material obtained from the carious teeth and alveoli of patients with lung abscess was equal to that of the material obtained from the abscess itself. In a large series of fusospirochetal infections of the lungs and bronchi, he found that, morphologically, the organisms obtained sterilely from the tracheobronchial tree by means of the bronchoscope and those found in gingivitis and in pyorrheic pockets were identical. Penta[11] further stressed the ease with which this highly infective material from the teeth could be aspirated into the deeper parts of the pulmonary system during sleep.

Similarly in bronchiectasis, which is the most common chronic pulmonary disease, there is a marked identity of organisms found in the suppurative foci of the mouth and the lungs. Bronchiectasis is a pulmonary disease characterized by a dilatation and destruction of the bronchial walls, associated with marked pulmonary suppuration. Again, the particular type of destruction of the bronchial walls caused by infections of the fusospirochetal group is significant.

Davis and Pilot[12, 13] have emphasized the burrowing, destructive nature of this type of infection and have stressed the rôle of these organisms in pulmonary abscess, gangrene and bronchiectasis. From bacteriologic, pathologic and clinical studies, they classify this type of infectious process as a distinct clinical entity. They state that "probably in all cases the sources of infection relate back to the teeth and tonsils where the fusiform bacilli and spirochetes and cocci are present in enormous numbers."

As regards the incidence of these infections, Smith[14] has found that, in a series of sixty cases of chronic bronchiectasis, forty-eight, or eighty per cent, showed spirochetes, fusiform bacilli, vibrios and cocci in the sputum that were identical to those about the gums. Every one of the sixty patients had pyorrhea.

The treatment of these two suppurative pulmonary diseases may be discussed together, since the fundamental principle of the therapy is the same in each case; namely, establishing and maintaining drainage of the suppurative focus.

Here again, as in the treatment of foreign bodies, prophylaxis must be stressed. In the presence of an acute pharyngitis or a severe Vincent's infection, exodontia should be avoided, the operation being postponed until the inflammation subsides.[4]

Because of the serious nature of these diseases, the internist, the surgeon and the bronchoscopist should jointly determine the therapy to be employed. Supportive measures consisting of absolute rest, repeated transfusion and a soft, high caloric diet are essential. The medical management further includes the administration of neo-arsphenamine, whether fusospirochetal organisms have been demonstrated or not. Strict attention to oral hygiene is obviously necessary.

The active treatment is directed toward establishing and maintaining adequate bronchial drainage. This is obtained by postural drainage, the patient learning to lie in whatever position affords the most thorough evacuation of the cavity or cavities. However, it should be supplemented by the better evacuation of secretions assured by bronchoscopic aspiration. Bronchoscopy, for both diagnosis and treatment, is definitely indicated. These procedures are all carried out under local anesthesia in adults, and without anesthesia of any kind in children.

In acute cases, the drop in temperature, reduction of cough and marked general improvement following establishment of adequate bronchial drainage of the abscess cavity are most striking. Those cases which do not show prompt response to these conservative procedures ultimately call for surgical intervention. External drainage, thoracoplasty and extirpation of the diseased portion of the lung by lobectomy or pneumonectomy are some of the surgical procedures employed.

SUMMARY

1. Aspiration of foreign bodies of dental origin into the tracheobronchial tree may cause severe pulmonary disease. Such accidents are surprisingly rare, but must be kept constantly in mind.

2. Postoperative pulmonary complications, such as lung abscess and bronchiectasis, may follow any type of oral surgical procedures.

BIBLIOGRAPHY

1. Jackson, Chevalier, and Jackson, C. L.: Diseases of Air and Food Passages of Foreign Body Origin. Philadelphia: W. B. Saunders Co., 1936.

2. Hedblom, C. A.: Foreign Bodies of Dental Origin in Bronchus; Pulmonary Complications. *J. D. Res.*, 3:301, September 1921.

3. Jackson, Chevalier: Peroral Endoscopy and Laryngeal Surgery. St. Louis: The Laryngoscope Co., 1915.

4. Frank, V. H.: Exodontia for General Practitioner. *D. Digest*, 44:18, January 1939.

5. Jackson, Chevalier: Bronchoscopic Cases of Dental Interest: Dental Foreign Bodies in the Air and Food Passages. J.A.D.A., 14:1341, August 1927.

6. Stern, L.: Putrid Abscess of Lung Following Dental Operation. *J. Thoracic Surg.*, 4:547, August 1935.

7. Meyerson, M. C.: Bronchoscopic Observations of Cough Reflex in Tonsillectomy Under General Anesthesia. *Laryngoscope*, 34: 63, January 1924.

8. Lintz, William: Respiratory Diseases and Teeth. *Med. J. & Rec.*, 133:62, January 1931.

9. Kline, B. S., and Berger, S. S.: Pulmonary Abscess and Pulmonary Gangrene: Analysis of Ninety Cases Observed in Ten Years. *Arch. Int. Med.*, 56:753, October 1935.

10. Penta, A. Q.: Oral Spirochetes and Associated Anaerobes in Pyorrhea and Pulmonary Suppuration. *J. Dist. Columbia D. Soc.*, July 1937.

11. *Idem:* Infeccao oral e espiroquetose bronchopulmonar. *Rev. brasil de tuberc.* 5: 685, October 1936.

12. Davis, D. J., and Pilot, Isadore: Studies of Bacillus Fusiformis and Vincent's Spirochetes. J.A.M.A., 79:944, September 16, 1922.

13. *Idem:* Studies in Fusiform Bacilli and Spirochetes: Their Rôle in Pulmonary Abscess, Gangrene and Bronchiectasis. *Arch. Int. Med.*, 34:313, September 1924.

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UNCONTROLLED VARIABLES IN AMALGAM, WITH SIGNIFICANT IMPROVEMENTS IN THE MAKING OF RESTORATIONS

By James T. Sweeney, D.D.S., Stockton, Calif.

VARIATIONS IN THE MANUFACTURE OF ALLOYS

THE various dental amalgam alloys on the market differ so much in particle size and in other characteristics that it is important to follow the directions of the manufacturer closely, if the best filling is to result from the particular alloy selected. We must always bear in mind that the responsibility of the manufacturer ends when he furnishes us the alloy and adequate directions for its use. The dentist is responsible for its proper manipulation. The variables in amalgam start with the manufacturer.

VARIATIONS ENCOUNTERED IN TRITURATION

Two popular accepted alloys are selected for illustration, because of their dissimilarity of manipulation. Alloy "A" as shown in the photomicrograph Figure 1 is pictured as it comes from the original container. The directions advise trituration for one and one-half minutes at a pestle pressure of 4 pounds. Trituration of this alloy (A) for but one minute without mercury at a pestle pressure of but 1 pound breaks the particles down considerably. (Fig. 2.)

Alloy "B" is popular with many because, it is claimed, further breaking down of the particles is not necessary.[1] (Fig. 3.) The directions furnished with alloy "B" advise trituration for from thirty to forty-five seconds with the lightest pestle pressures, as the particles are said to be of the correct size that will insure adaptation to the cavity walls and, at the same time, make a filling with all of the qualities that dentists demand.

The next, and very important, variable in our technic is the mortar and pestle. (Fig. 4.) Little has been written about this variable. We have in use today three distinct types: (a) the raised center glass mortar with the moderately well-fitted pestle; (b) the more common glass-bowl type, with the loosely fitted pestle and (c) the steel mortar with the pestle ground to fit closely. The fit of the pestle to the mortar, as well as the degree of roughness or smoothness, is important.[2] I have determined by actual trial that a well-fitted steel mortar and pestle will triturate an amalgam mix of a given size two or three times faster than a glass bowl with a loosely fitted pestle. If trituration for two minutes at a pestle pressure of 4 pounds and with a smooth, loosely fitting mortar and pestle amalgamates a given alloy properly, we shall overtriturate if we substitute a rough well-fitted mortar and pestle, or vice versa. Further, it is impossible to be sure of a given pestle pressure without a special pressure-regulating device. Also, the size of the mix and the mercury-alloy ratio will both affect the result. A mix of 1.0 gm. (16 grains) of alloy will require more time than a mix of 0.5 gm. (8 grains), if all other conditions are identical.

With fifty-one accepted alloys avail-

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able to the profession, the variations that exist are many. Our research workers, men of outstanding ability, have spent much valuable time as well as money on the problem of trituration. It is obviously one of the most important variables in our amalgam technic.

How may we simplify and standardize the technic for so many different alloys? Amalgamating all in the same way, with the same mortar and pestle, will not cause each alloy to yield the best amalgam that it is capable of yielding if it is amalgamated in the particular way that is best suited to it. The solution of this problem may come through a general use of the pressure-regulated mortar and pestle, or through controllable mechanical amalgamators adapted to amalgamate particular alloys correctly, as specified by each manufacturer. Figure 5 illustrates two pressure-regulated mortars and pestles.

Figure 6 illustrates a controllable mechanical amalgamator. This amalgamator is actually a mortar and pestle which triturates and comminutes the coarser alloy particles as a glass hand-operated mortar and pestle would do, but with greater speed. In seven seconds,

Fig. 1.—Alloy "A" as it comes from container. (×75.)

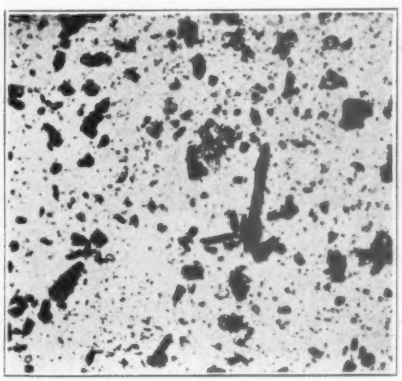

Fig. 2.—Alloy "A" after one minute dry trituration at 1 pound pressure. (×75.)

Fig. 3.—Alloy "B" as it comes from container. (×75.)

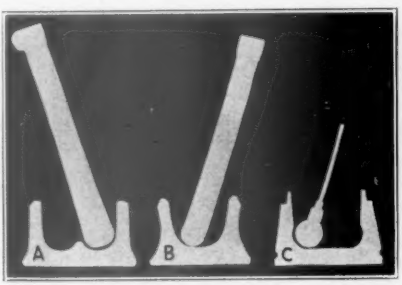

Fig. 4.—Cross-section of various types of mortars and pestles. A, Raised center type: B, common bowl type; C, well-fitted steel type.

it will triturate so well a 1-gm. (16 grain) mix of alloy C (Fig. 7), which requires two minutes for trituration by hand, that its amalgam meets with all A.D.A. requirements.

Figure 8 is a photomicrograph of the same alloy after one minute dry trituration by hand at a pestle pressure of 2 kg. (4 pounds), while Figure 9 shows the alloy triturated dry in the mechanical amalgamator for four seconds. It is interesting to note that the comminution is approximately the same in the two cases.

My purpose is to show the attempt of the alloy manufacturer to furnish us an amalgam rather than an alloy—an attempt on the part of the manufacturer to assume the responsibility of trituration.

Trituration for the purpose of further comminution is a continuation of the process of manufacture, and it is only fair to us that the manufacturer should provide for proper completion of the process rather than have 60,000 different dentists in the United States finish the job in 60,000 different ways. This step on the part of the makers of dental alloys may, I believe, lead to a definite amalgam technic.

VARIABLES ENCOUNTERED IN PACKING

Evidence as to the fit of the condenser to all angles and curves of a cavity was gained in packing specimens for tensile strength tests. The mold used for making tensile strength tests is formed of a rectangular central cavity, extended at each end by enlarged cylindrical cavities. The finished, packed specimen resembles a dumbell. Specimens of much greater strength were achieved after a condenser was designed with a face which fits the central rectangular area and the curved areas at the same time. (Fig. 10.)

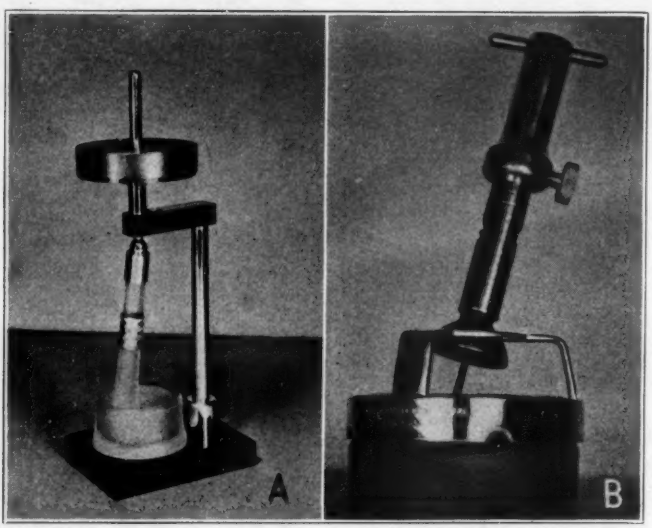

Fig. 5.—A, Hollenback mortar and pestle. B, Crescent mortar and pestle. Accurate pestle pressures can be had with either of these mortars.

This experiment indicates that the fit of the instrument to the angles of the cavity results in a stronger finished filling. Hundreds of cavities in extracted teeth were found to be bound by angular and plane surfaces, as well as by curves. No condensers were found on the market which could fit each angle and cover

enough of the amalgam being condensed. I designed a set of six faces and have used them continuously for the past five years. This set is by no means complete. Improvements will be made in the future. One handle serves for the entire set of condensers. (Fig. 11.)

Fig. 6.—Controllable mechanical amalgamator ("WigLbug") with timing device.

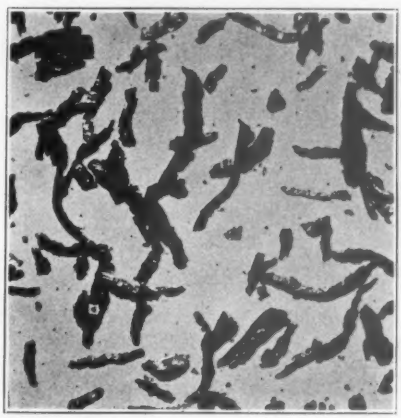

Fig. 7.—Alloy "C" as it comes from container. (×75.)

The condenser points fit into a slot in the handle; which permits them to rotate freely in such a manner that any given point automatically adjusts itself to fit the contour of the cavity wall. The shank of the condenser point is so shaped that a ledge (b) is formed near the face; which permits the excess mercury to be expelled as the filling progresses. This eliminates the necessity of attempting to remove the

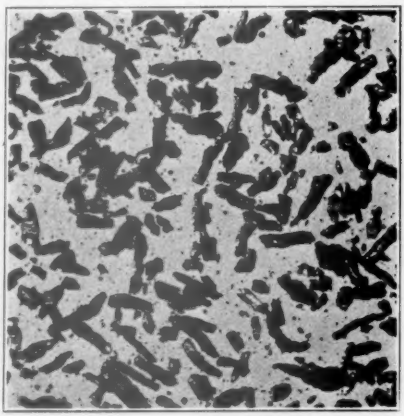

Fig. 8.—Alloy "C" after one minute dry trituration (without mercury) for one minute by hand.

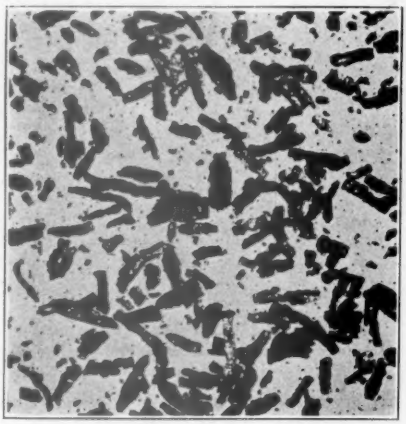

Fig. 9.—Alloy "C" after four seconds dry trituration in amalgamator; particles broken up to same degree as in one minute trituration in hand mortar and pestle.

excess mercury after the packing is completed. The shapes of the condenser faces

that are used most are illustrated in Figures 12-14.

In Figure 12, the condenser point is in position to pack the material well into the gingival locks. Thorough condensation with the elimination of the excess mercury at this stage, the beginning of the filling, as well as at every other stage, tends to assure a more compact and, therefore, a stronger filling. In Figure 13, the condenser point is in a position not only to pack the material in the acute point angles, but also to remove the excess mercury immediately. A useful and well-fitting condenser is illustrated, in relation to the cavity, in Figure 14. This condenser point is used in all occlusal cavities and occlusal portions of Class II and mesioclusodistal, cavities. The two condenser points illustrated may be used in about three-quarters of all cavities. The four other designs are for exceptional locations.

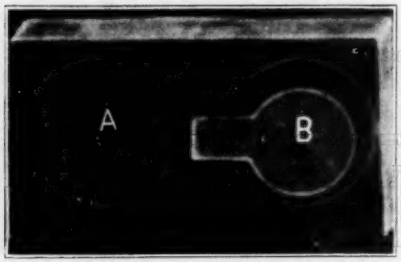

Fig. 10.—Diagram of tensile strength mold (a) showing condenser face (b) in position.

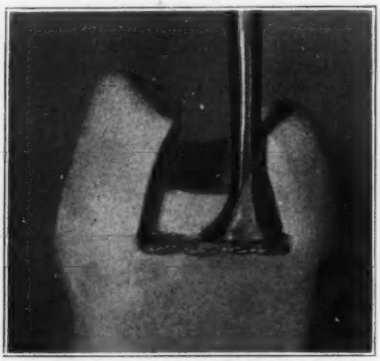

Fig. 12.—Condenser in position to pack into gingival locks.

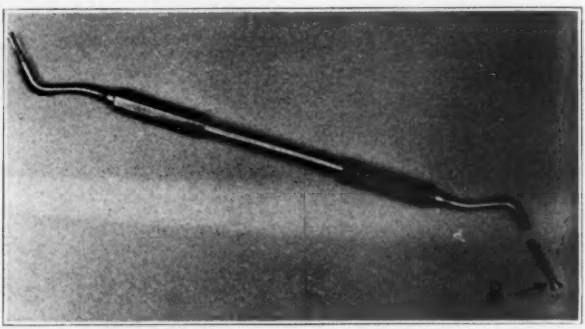

Fig. 11.—Double-end handle showing method of attaching one of the condensers. B, Ledge on condenser shank to assist in eliminating excess mercury as filling progresses.

CLASS III AND CLASS IV AMALGAM FILLINGS

Most of the difficulties experienced in placing amalgam fillings in the anterior teeth can be traced directly to the matrix, the slightest movement of which causes a "landsliding" of the previously condensed mass, resulting in a weakened, porous and unsightly restoration. But access to the cavity must be had, even if some rigidity of the matrix has to be sacrificed. My work on the thrusts that could be safely used in packing fillings in the anterior teeth proved that but 2 kg. (4

pounds) pressure could be exerted before distortion of the matrix occurred. It is well known that such weak forces cannot always condense amalgam adequately. It seems to be the slowly applied hand thrusts that cause the "landsliding" of amalgam.

In my search for a method of condensing amalgam well in anterior teeth, without the slow thrusts used in applying pressure by hand, I tried the technic used in condensing gold foil with the hand mallet. The few hand-malleted fillings that were placed served very well and were clinically superior to the fillings packed by hand thrusts; but the technic used with the ordinary hand-operated foil mallet was so awkward that it was discarded in favor of the automatic pneumatic condenser designed by George M. Hollenback. The peculiar action of this condenser seemed ideal for our purpose, because a predetermined thrust must be exerted on the handle before the hammer trips, and the air-driven blows are struck in rapid succession. Not only the thrust on the handle, but also the number of blows struck at each thrust, are under control of the operator at all times. "Landsliding" has been controlled to a remarkable degree. Matrix movement has been reduced to a minimum because of the steady pressures exerted upon the amalgam while the blows are being struck upon the far end of the condensing tool.

Class III and Class IV amalgam fillings placed with this mallet in March 1938, more than a year ago, seem to be as lustrous and as tight as on the day they were placed. Hand-packed fillings adjacent to the malleted fillings are clinically inferior.

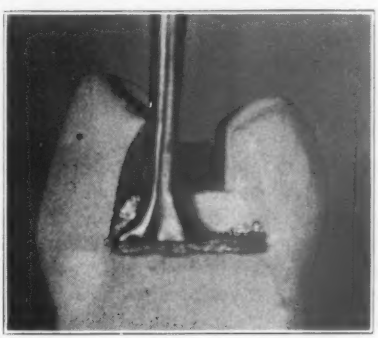

Fig. 13.—Condenser in position to pack along axial walls. Mercury is eliminated as filling progresses.

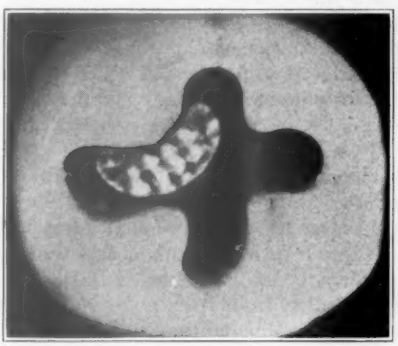

Fig. 14.—Universal condenser point for all occlusal cavities. This point automatically adapts itself to the contours of the cavity walls.

PHYSICAL PROPERTIES OF AN AMALGAM CONDENSED WITH AUTOMATIC CONDENSER

The ease and speed with which the Hollenback mallet can be used for amalgam, as well as the clinical appearance of the fillings condensed with its aid, led me to investigate the strength and other physical properties of test specimens. For these tests, alloys were used for which the manufacturer could furnish the data on the properties of each batch that we were using. The particular alloy selected was rated by the manufacturer as having a tensile strength of 7,851 pounds per square inch and a crushing strength of 46,126 pounds per square inch. The identical molds used in the manufacturer's test were borrowed, so that the speci-

men would be of the same dimensions. The tests packed with the Hollenback mallet and triturated in the controllable mechanical amalgamator attained a tensile strength of about 11,000 pounds per square inch and a crushing strength of about 68,000 pounds per square inch. Thus, the use of the controllable mechanical amalgamator with the Hollenback mallet appeared to increase the tensile strength by about 44 per cent and the crushing strength by about 43 per cent.

E. W. Skinner, of Northwestern University Dental School, cooperated by conducting tests for dimensional change and flow, also using the Hollenback condenser, and closely following the technic which was used in the tests made in our own laboratory. He found that the specimens expanded normally and the flow was reduced 50 per cent. I made further tests for adaptation, using extracted teeth for the test molds. Fillings were malleted into cavities prepared in the teeth. Immediately after packing, the tooth bearing the filling was put in a bottle of fuchsin stain (prepared by dissolving crystals of fuchsin in plain tap water) and kept in an incubator at body temperature for from twenty-four hours to seven days. Nine-tenths of such tests, including large mesioclusodistal and complicated fillings, were very satisfactory.

Up to the present time, about 200 amalgam fillings of all classes condensed with the Hollenback mallet have been placed in actual practice in different mouths. These fillings appear to be clinically superior to the adjacent hand-packed fillings. The usual opening of the margins that has appeared with most hand-packed Class II and Class IV fillings did not occur. I have yet to see one of the malleted fillings, no matter how large or how complicated, change in dimension or luster. The fillings appear to be very dense and the luster seems to be permanent. It would be premature to conclude at this time that the malleted amalgam filling is superior to fillings of other types; but it is certain that this work at least warrants further investigation. Not only are the few tests that I have made insufficient, but also they have not yet been corroborated by others.

CONCLUSIONS

1. Trituration appears to be one of the greatest variables in present amalgam technic. The manufacturer can control this variation by furnishing the dentist with mechanical means for the trituration of each specified alloy, thereby standardizing the technic as well as assuming responsibility for the amalgam rather than for the alloy.

2. Amalgam condensers should be designed to fit and to condense amalgam into undercuts and angles in the cavity depths, to eliminate excess mercury as the filling progresses and to thoroughly condense the amalgam along the cavity walls.

3. Trituration with the aid of the controllable mechanical amalgamator, together with condensation, using the Hollenback automatic pneumatic mallet, has resulted in test fillings of a strength approximately 40 per cent greater than hand-triturated and hand-packed fillings. Condensation with the mallet in test fillings has resulted in 50 per cent reduction in flow over the hand-packed type, while the expansion remained normal.

4. It may be further concluded that the mechanized method of placing amalgam fillings eliminated guesswork and the human element to a remarkable degree. It is time saving and simple, and probably more accurate than the uncontrolled technic used at present. From observations of the few tests made in the past year (about eighty), it appears that the fillings are more nearly uniform, undergo less volume change and gain about 40 per cent in strength.

5. It is significant that while the ten-

sile strength has been increased about 44 per cent, the flow has been decreased about 50 per cent.

6. The tests showed that the top of the specimen had a hardness equal to that of the bottom. When there is a slight difference, the bottom of the specimen has in all cases been the harder.

BIBLIOGRAPHY

1. Coy, H. D., and Leibig, E. O.: *D. Items Int.*, 60:135, February 1938.

2. Ward, M. L., and Scott, E. O.: Effects of Variations in Manipulation on Dimensional Changes, Crushing Strength and Flow of Amalgams. J.A.D.A., 19:1683, October 1932.

State Hospital.

THE ILLEGAL PRACTICE OF DENTISTRY

By Walter A. Wilson,* D.D.S., Trenton, N. J.

THE illegal practice of dentistry dates back to the very day that the first license or privilege was granted legally on the basis of certain qualifications for the practice of dentistry as a profession. Laws to protect the public against unqualified practitioners have been placed on the statute books of the various states and have from time to time been amended and improved to meet the ever-changing conditions. Whether there exists proportionately more or less illegal practice today than in years gone by, it is difficult to say. We do know that there is today widespread practice of dentistry by men who are not only unlicensed, but also ill-equipped mentally, educationally, morally, physically or hygienically to do any type of dental work on human beings.

Discussion of this subject will be limited here to those who operate without a license, and will not include licensed dentists who may violate dental laws in devious ways, such as illicit advertising and malpractice. It has been my experience that the rank and file of practicing dentists either are not conscious of the extent of illegal practice or are so complacent as to not recognize its real and potential menace to the public and to the present and future of the dental profession itself. If we can but arouse the interest of the profession to the importance of a united effort to stamp out this evil, we shall have accomplished a useful purpose, for an aroused profession can go far toward abolishing this practice. The statements made here are based on experience in the State of New Jersey, and while circumstances, such as different laws, the character of the population—whether rural or urban—the size and location of the state, etc., may alter the problem, it is evident, from reports coming from most of the states, that the problem of the illegal practitioner is universal.

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SELF-REGULATION OF DENTISTRY

The profession of dentistry is truly a democratic institution, being largely a self-regulating, self-governing body of society. That we have well managed our profession is evidenced by the great strides made educationally, ethically, scientifically and legally in the short space of one century. That there is still much to be done, no one will deny, and one of our unfinished duties and responsibilities to society is the elimination of the illegal

practitioner. Society has given us the right to govern ourselves, and it is surely our obligation to protect society from imposters, to the best of our ability.

WHY IMPORTANT

When illegal practice is mentioned to certain dentists, they respond with the flippant "So what?"—the implication being that an illegal practitioner here and there does them no harm; so why worry? This indifference has greatly hampered the efforts of those charged with prosecuting the law violators, and it indicates an attitude not truly professional. It also indicates a false sense of security from a failure to take into account the possible inroads on dentistry that this practice, if unchecked, may make in the future, and its probable effect on the future trends of the profession.

WIDESPREAD EXISTENCE

Illegal dental practice is carried on on a large scale in this, the country most advanced in dentistry. This is said with conviction, for the evidence is available. Every one connected with dental law enforcement can vouch for the truth of the statement. Only constant vigilance and strenuous efforts keep it at its present level, but the weapons at hand are insufficient. In most places, two weapons which need sharpening are: (1) greater cooperation of licensed dentists and (2) stronger dental laws with more teeth and stricter penalties. Progress is being made along these lines. If we were to say that the illegal practice of dentistry constituted a million dollar racket in this country, we would undoubtedly be grossly underestimating in dollars and cents the amount of dental work done by these law breakers. But the monetary significance fades by comparison with the damage done to the health of the patients victimized and the deteriorating influence on the prestige and future of the profession of dentistry.

THE ATTACK

The state dental board is charged with the responsibility of enforcing the dental act. Investigators are engaged to obtain evidence of illegal practice. Complaints are received from numerous sources, but most leads are obtained from dentists to whom patients go to have their dental work redone, or a condition caused by poor work treated. Reports come from hospitals, from police departments, from courts where victims are seeking redress and from patients who tell their dentists of friends who had work done cheaper by a man—"not a real dentist." But the report of a violator is only the beginning. The dentist may believe that only a report is necessary for an immediate arrest; but, in this democratic country, the laws give every one the benefit of the doubt and thus it is necessary to obtain unimpeachable, substantiated evidence of illegal practice. Patients of the illicit practitioner are usually reluctant to testify against him, fearing reprisals or publicity. It therefore evolves upon the dental board to secure evidence by sending investigators to have dental work performed by the reported violator, so that testimony as to the illicit act can be given in court.

AN ACTIVE COMMITTEE OF PROSECUTORS

A method of keeping a check on illegal practitioners which has proved successful is the establishment of a working committee of "prosecutors" to cooperate with the board in tracking down violators. This committee of the state dental society consists of one member from each county. We have twenty-one prosecutors with a chairman who is a member of the state board. The secretary of the state board acts as secretary of the committee. These prosecutors are charged with the responsibility of reporting all cases of suspected illegal practice in their counties, and of assisting in securing necessary witnesses and evidence. It has been

found that dentists who are reluctant to be the complainant against any one in their county are willing to report the violator confidentially to the local prosecutor, who, in turn, presents the information to the state board. When a case reaches court, the prosecutors are often present to give help as experts or to assist the prosecuting attorney in any way possible. The board investigator works with the "prosecutors" in the respective counties on the cases under investigation in those counties.

Meetings of all state prosecutors are held two or three times a year to discuss the prosecution work and to recommend ways and means of better coping with the situation. Reports on pending cases are discussed, and only men who are interested in and willing to promote the work of prosecution are now appointed to this committee, once considered just a place to enable men to receive honorary mention on the society's list of committees and now become of major importance.

CONDITIONS FOUND

Investigation has uncovered a "racket" so dangerous to public health that any one interested in a health profession should feel it his unswerving duty to lend a hand to abolish it.

While the practice of dental quacks has been found to include all types of dental work—filling and extracting teeth and placing porcelain jackets, bridgework and dentures—most of their attention is directed to making dentures. The reasons for this are obvious: a quick turnover, more money, less risk. Most of these violators nowadays shy at extracting teeth, even to prepare their patients for bridges and dentures. Rather, they send their victims to clinics or licensed dentists for the extraction, with instructions not to divulge where they are to have their teeth made.

Another unhealthy alliance which has become evident of late is the wilful cooperation of licensed dentists with violators. Licensed dentists do the operative work and prepare the patient for the prosthetic work to be done by the illicit operator. What traitors to their profession and perverters of the privilege granted them to practice a profession! We have brought such men before the board to ascertain just what reasoning was behind such shortsightedness. It is the old story of giving preference over professional ideals to the almighty dollar. In economic stress, they say, "Well, if I didn't do it, some one else would, and I needed the money." Will education reach deeply enough to uproot such a lack of principle?

HOW ILLEGAL PRACTICE IS CONDUCTED

The ways of the illegal operator are many. There is the itinerant quack who goes to homes, taverns, etc. Some work entirely in their own homes, in cellars, kitchens, bathrooms. Others work in dirty laboratories, using the laboratory as a "cover," but usually not doing much technical work for dentists. Some are found to be laboratory technicians who accept work from dentists, and, at the same time, carry on a private illegitimate practice among their friends and friends' friends. The latter are the rats, if we may use the expression, who would bite the hands that feed them, who would be among those present if they could find the opportunity to snatch prosthetic dentistry from the dental profession. It is this type which is more dangerous to the dental profession than other violators, for, given a little confidence through the dental profession's assigning them technical work, they picture themselves equipped to serve the public. A taste of serving the public stimulates their appetite, and they are the first to be heard crying for licensure of technicians. Dentists should be careful in whom they place their confidence in assigning work to technicians. Reputable laboratories and technicians will not violate the law.

Certain others refrain from violation in fear of the ire of the profession and because a conviction is too costly in the way of hard-earned trade—and it should be costly.

The itinerants and other typical bootleggers of dentistry ply their trade in various ways. Usually, they have a few "feeders," who get either a commission or free work or free drinks to send patients to them. Both the feeders and the practitioners are usually very "cagey" in accepting or referring patients. You must be "well" recommended, or at least "properly." Bartenders, beauticians, barbers, storekeepers and, yes, policemen have been found to be feeders for these quacks. As before stated, most of their practice is denture work, with impressions taken in filthy trays, with unwashed hands, and re-used compound and wax, in dirty rooms. Conditions are almost uniformly vile.

THE PATIENTS

Who would go to these fellows? It's the old story: Offer some people something wholesale and they will go miles out of their way and put up with all kinds of abuse. One dental prosecutor who has seen the workings of this racket said, "If I, with my license, were to go into a one-room laboratory and pretend I was a faker without a license, passing out the word that I was good, but had to work under cover because I was 'illicit,' I'd get all the work I could do at the same fees I'm getting now." Perhaps it is human nature, but the fact remains that we find some of these fakers working with full appointment books on every type of person from laborers to bankers and ex-judges, and usually it's the same incentive—getting something cheap; and it usually is cheap in every respect. The fees, however, are not always low. We have found cases in which from $10 to $500 was paid to these men for dental work. The type of work done is almost uniformly bad, an occasional operator displaying mechanical skill, but seldom good judgment.

Those engaged in illegal practice in general are of a very low type. Seldom are they possessed of much education or technical training. Usually they are devoid of moral fiber, and frequently they are persons of poor habits—personal, social and hygienic. Many have obtained their meager contact with dentistry while working in commercial dental laboratories or in trade schools. Some are dental mechanics doing illegal work on the side, so to speak; while others make it their full-time business to carry on an illicit practice. It is not unusual to find them working by appointment, with full appointment books, while licensed dentists in the same neighborhood sit in their offices with time on their hands.

SUB ROSA PRACTICE

Because of the fact that most states require an annual registration of licensees, there is little illegal dental practice carried on in the open. On the contrary, it is carried on sub rosa. The dental boards know, or should know, where every licensee is located, so that any activities of imposters are quickly detected. While forcing illegal enterprise under cover greatly limits the extent of the operations possible, the nature of the under-cover activities makes their detection equally difficult.

THE DANGERS

The potential dangers to public health from illegal practice is reason enough for concern. We need not be reminded of the tragic results of unscientific, unsanitary dental treatment or wrong diagnosis. The spread of disease and ruination to mouths and lives are obvious.

If the public were fully and properly informed of these dangers, many might be deterred from risking their lives and health in the hands of unlicensed practitioners. We have launched a campaign of education along this line. News re-

leases to the press and to magazines telling the truth about this public menace have already appeared. These articles are prepared for public consumption under the guidance of the Greater New York Bureau for Dental Information, of which our state society is a cooperating member. Discretion must be used in the type of material released, to avoid untoward repercussions.

As to the dangers of illegal practice to the dental profession, they are manifold. First, and of no mean importance, is the actual amount of dental work in dollars and cents done by these men and of which the dentist should be the sole recipient, after spending years of training, thousands of dollars and much effort to secure, under our laws, the privilege of caring for the dental needs of the people. This right to the just returns from dental service must be preserved for the benefit of the public and the profession. Failure to stop inroads now will make the task difficult or impossible in the future should social trends continue in a direction now apparent. Any increase in illegal practice may furnish a wedge to divide the dental profession.

OBSTACLES TO ABOLITION

Those who are making a serious attempt to abolish the illegal practice of dentistry know that they face a difficult problem. The obstacles are so many that we can only touch lightly on each. A mere mention of the various hindrances will suggest ample reason to try to overcome them. Inadequate laws, including insufficient penalties, doubtful legal representation and improper definition of who is considered as practicing dentistry are among the chief obstacles in most states. We are now considering amending our definition of dentistry, as has been done in several states, more exactly outlining of what the practice of dentistry consists. We have increased the penalties, making a set fine or jail term mandatory, and have, in New Jersey, been fortunate in having an assistant attorney general who has been very successful in the prosecution of our cases in recent years. But when the law provides that the state assign the attorney for the prosecution of cases, there is always doubt as to the possible standard of legal representation and the politics that may be involved with any change of administration. It is important that the state societies support the state boards in insisting on good legal representation devoid of political entanglements. A plan such as we have in New Jersey, in which the secretary of the board is the prosecuting officer and is elected by the board and not politically appointed nor an actual member of the board, has proved to be a bulwark against many attempts at political pressure.

As in most law violations, the dental law offender almost always has some political friend to whom he goes to "get the ticket killed." This influence has been found to reach office holders and politicians in high places. Often, dentists are prevailed upon to intercede with the board. Boards must take a stand that the health of the people and the very life of the profession are not to be bartered in exchange for political patronage. Once a board makes it clear that it is adamant on this point, the instances of attempted political pressure will become few. We are fast establishing in the minds of the politicians and courts that the matter of illegal dental practice is a public health problem and that the dental profession is therefore unanimously interested in its vigorous prosecution. Political office holders do not often interfere with the dental profession, but should be and usually are anxious to cooperate in every way possible in protecting public health.

SHARING THE BLAME

Dentists are too reluctant to furnish information regarding violators to their state boards, and are in many ways re-

sponsible for many abuses. The sending of patients directly to laboratories with plates to be repaired, dependence on laboratory technicians for work which the dentist should do himself and patronage of known law violators all go to encourage illegal practice. In this, the dentists are shortsighted and must share the blame for existing conditions.

EDUCATION AND PUBLICITY

There has been a decided lack of education of both the public and the profession regarding the evils of the problem at hand. The profession must be kept informed and aroused as to its importance. The public must be warned of the dangers of cancer, syphilis, infection and injury from patronizing these law breakers. It must likewise be more fully apprised of the importance of professional dental treatment and the value of treatment rendered by one who has studied scientific methods and who, through his dental organization, keeps abreast of modern developments in dentistry. On this subject, dental education of the public, much could be written as to proper and ethical methods of approach. But, with study of the problem, dental education of the public is possible.

SUMMARY

While it has been necessary to generalize on the importance of action rather than on details of methods to be used in combating the menace of the illegal dental practitioner, from these generalizations we can draw numerous definite recommendations which may apply in whole or in part in every state:

1. Enactment of more adequate dental laws.

(a) Better definition of who is considered as practicing dentistry.

(b) More severe penalties.

(c) More adequate prosecution systems.

2. Organization of active committees of "prosecutors."

(a) Arousing the interest and cooperation of the profession.

3. Elimination of all political bartering in health.

4. Education of the dentists.

(a) In meetings and dental periodicals, warning the dentists against cooperation with and encouragement of illegal practitioners.

(b) Informing the dentists of the real and the potential danger to the prestige of the profession.

5. Education of the public.

(a) Through newspapers, magazines and other media, warning the public of the dangers of patronizing quacks.

(b) Informing the public of the value of professional dental service.

6. An alert attitude toward all attempts at legislation to weaken or divide the dental profession.

7. Cooperating with dental boards.

(a) Assisting board investigators in every way possible.

(b) Reporting all violations.

8. Promotion of greater uniformity in dental laws.

9. Keeping faith with the public by keeping the motive of service paramount to that of profit.

10. Having men on dental boards who are primarily interested in serving dentistry and not in personal aggrandizement.

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CARBOHYDRATE DEGRADATION BY MOUTH ORGANISMS. II—YEAST

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SINCE Miller and Black[1, 2] first proposed the chemicoparasitic theory of dental caries, many factors in the disease have been studied and many new theories have been proposed. At the present time, most research workers believe that the process in general is a chemical bacterial phenomenon and that systemic factors merely contribute to or alter in some way the local environment. Although it is generally conceded that bacteria play a major rôle in the production of acids, the mechanism of the acid formation and the identity of bacteria that regulate this mechanism are rather obscure.

Bunting, Jay and their co-workers[3] have been investigating the environmental factors for many years. As a result of these investigations, they think *Lactobacillus acidophilus* the predominant organism associated with the disease and the one largely responsible for the acid formation. On the other hand, Anderson[4] finds almost as close a correlation with certain strains of streptococcus and feels that this organism may probably be as important as *Lactobacillus acidophilus*. It has further been suggested[5] that yeast may be one of the factors in the production of acids so far as it has been found that this organism, under conditions similar to that found in the mouth, produces more acid than any other mouth organism. There is, however, little doubt that carbohydrate plays a very important rôle, no matter what organism or combination of organisms is responsible for its degradation.

In 1936,[5] it was suggested that no one organism could possibly produce acid sufficiently rapidly to cause decalcification of the teeth under conditions that are found in the mouth, and that the mechanism for acid production was more highly involved than was first suspected. In 1898, Buchner[6] discovered that fermentation was not a function of the living organism, but was dependent on an enzyme system manufactured by the organism. Since that time, a host of workers[7, 8, 9, 10] have studied carbohydrate degradation by various enzyme systems, bacterial, muscle or of plant origin, and have found that a certain system or chain of reactions is necessary for the production of acids from carbohydrate material. These reactions involve a production of hexose monophosphoric acid, hexose diphosphoric acid, phosphoglyceric acid, glycerophosphoric acid, pyruvic acid and lactic acid. It is now generally conceded that this chain of reactions is a universal phenomenon associated with the degradation of carbohydrate material, the first part of the series of reactions being essentially the same. The end-products, such as lactic acid, alcohol, acetic acid, propionic acid, glycerol and other compounds, are determined by the enzyme system and the results are determined by minor changes in the reactions during the later stages.

In 1936,[5] it was suggested that the same reactions may explain the mechanism by which the lactic acid is formed in carious lesions, and subsequently[11]

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many of these intermediate compounds were isolated from fermentation of saliva, glucose and enamel mixtures. This indicated that the proposed series of reactions actually take place in the mouth during the formation of acids, which subsequently decalcify the teeth. In addition to this, Stephan[12] has found that the pH in carious lesions is at times extremely low, indicating a high acid potential in certain carious lesions, or in susceptible areas of the mouth. According to the foregoing, it is quite logical that the acid formation in the mouth is due to an enzyme system which is contributed to by possibly every organism present in the mouth, and possibly from the saliva or oral tissue itself.

On this basis, it was thought that if the exact rate at which each organism found in the mouth would cause each of the steps of carbohydrate degradation to proceed were determined, we could tell which combination of organisms would be most effective in the production of dental caries. For instance, if each of five organisms would carry one of the five steps in the chain of reactions at a rapid rate, a combination of these five organisms would form acid at a very rapid rate; while if only four of the reactions were present, the acid formation would be only as rapid as the slowest of the five reactions. For this reason, an attempt was made to determine quantitatively the rate and path of reaction of carbohydrate degradation to lactic acid under the influence of various mouth organisms.

This paper deals with the degradation of carbohydrate to lactic acid by mouth yeast.

EXPERIMENTAL PROCEDURE AND RESULTS

The general method used in all work was to allow a weighed quantity of the organisms to act for a given period of time on each of the intermediates involved in the degradation of glucose and then analyze the substrate quantitatively for the next intermediate compound. All reactions were run at three pH values: 5.4, 6.7 and 8.6. The first and last values were chosen because the work of Bodansky and others[13] has shown that the optimum pH for phosphatase from various sources is either one or the other of the values. The intermediate value of 6.7 was chosen because this probably represents approximately the pH of normal saliva. It might be mentioned in this connection that the pH of saliva varies widely. Resting saliva is usually acid, values as low as pH 5.75 having been observed. On the other hand, stimulated saliva is almost invariably alkaline and may attain a pH as high as 8.0 or slightly above.

The yeast used in this investigation was isolated from human saliva or from the scrapings taken from the teeth. The yeast was isolated in pure culture by the usual methods and grown on a solid 1 per cent dextrose-agar medium. Since large numbers of the organisms were required, the usual methods of culturing did not readily lend themselves to the problem at hand. New methods of growing the yeast on a large scale had to be devised. Several methods were tried, but the most satisfactory proved to be the use of flat quart-size icebox water bottles. About 100 ml. of the medium was placed in each bottle, which was then plugged with cotton. The medium was sterilized by autoclaving for twenty minutes at 15 pounds pressure. The bottles were then placed on the side to cool. For inoculation, a suspension of pure mouth yeast in sterile physiologic sodium chloride solution was used. About 3 ml. of this suspension was pipetted into each bottle from a sterile pipet. The bottles were then incubated for twenty-four hours at 37° C. The yeast cells were harvested in sterile physiologic sodium chloride solution and examined microscopically for contamination. If this had occurred, the cultures were rejected. The saline suspension of organisms thus obtained was

centrifuged in large pyrex tubes. The supernatant fluid was removed and dried in a vacuum dessicator over anhydrous calcium chloride. Before use, the thoroughly dried yeast was ground to a fine powder with a mortar and pestle. In this way, the yeast could be weighed out accurately on an analytic balance and thus place the work on a quantitative basis. Organisms prepared in this way are obviously not in an actively growing state, but the enzymes contained in them are still present and capable of the usual reactions.

I. PHOSPHORYLATION OF GLUCOSE BY MOUTH YEAST

According to the Meyerhof scheme, the first reaction involved in the degradation of glucose by yeast involves the esterification of this compound by phosphate. The reaction is promoted by an enzyme known as phosphatase. The initial products formed are a mixture of hexose monophosphate and hexose diphosphate. Several methods have appeared in the literature for the determination of these two compounds each in the presence of the other. One method introduced by Lehmann and reviewed by Cahn and Houget[14] is based on the rate of hydrolysis of these esters at 100° C. in a medium of normal hydrochloric acid. Harden and Henley[15] have also introduced a method which is based on the difference in solubility of the barium salts of the two compounds in question. This method of Harden and Henley was finally adopted with one modification: free and total phosphate determinations were made by the method of Martland and Robison[16] instead of by the method of Neuman.

To 30 ml. of 10 per cent glucose solution was added 4 gm. of dry, powdered mouth yeast. Toluene 0.5 ml. was also added as a preservative. This mixture was allowed to incubate at 37° C. for one hour with frequent shaking in order for equilibrium to become established. At the end of this time, 15 ml. of 0.67 molar phosphate buffer of the proper pH was added and the mixture shaken thoroughly. Samples were then immediately withdrawn for phosphate and glucose analysis. The remaining mixture was placed in the incubator, where it was allowed to remain with frequent shaking for four hours. At the end of this time, the pH was measured by means of the glass electrode and analyses run on the centrifuged substrate for reducing substances, free phosphate, hexose monophosphate and hexose diphosphate. Glucose analyses were made by the quantitative method of Benedict. Hexose monophosphate and diphosphate were determined by the method of Harden and Henley, as follows: To the centrifuged substrate was added sufficient 25 per cent trichloracetic acid to raise the concentration to 3.5 per cent. The liquid was centrifuged to remove protein and the amount of free and total phosphorus was estimated in the supernatant fluid. To another sample of the supernatant liquid was added excess 50 per cent barium acetate and enough hot baryta to render the liquid just pink to phenolphthalein. Enough carbon dioxide was then bubbled through the solution to just remove the pink tint. One-ninth of a volume of alcohol was added and the resulting mixture allowed to stand in the icebox overnight. After filtering, the free and total phosphate were again estimated in the filtrate.

It is assumed that, in this treatment, the large concentration of barium ions present decreases the solubility of the barium hexose diphosphate to such an extent that, in the presence of one-ninth of a volume of alcohol, this salt is completely precipitated along with the free phosphate present; while the readily soluble barium hexose monophosphate is left in solution. The amount of the latter is calculated from the combined phosphorus found in the liquid. The amount of diphosphate is estimated from the total combined phosphorus less that re-

maining in solution after precipitation. The results obtained in each are given in Table I.

II. PRODUCTION OF PHOSPHOGLYCERIC ACID BY MOUTH YEAST

Extensive investigations by various workers have shown that this three carbon acid plays an important intermediary rôle in the dissimilation of glucose by the enzymes of muscle and bacteria. In this work, the phosphoglyceric acid has been isolated as the barium salt when mouth yeast was allowed to act on a mixture of glucose, hexose diphosphate, sodium pyruvate and phosphate buffer in the presence of toluene and sodium fluoride. This is the reaction proposed by Meyerhof for alcoholic fermentation during the so-called stationary phase. The hexose diphosphate is necessary as a catalyst and the sodium pyruvate as a hydrogen acceptor. The toluene is used as a preservative and the sodium fluoride in suitable concentration protects the phosphoglyceric acid formed from further breakdown by poisoning the enzyme necessary for its decomposition.

The general method of Stone, Wood and Werkman[8] was employed for this determination. In each of several 125-ml. Erlenmeyer flasks were placed: 7 gm. of yeast paste, 7 ml. of 0.67 molar phosphate buffer of the desired pH, 6 ml. of 20 per cent glucose, 5 ml. of 2.5 per cent sodium hexose diphosphate, 1.5 ml. of 0.2 molar sodium fluoride, 1 ml. of toluene and 8 ml. of 5 per cent sodium pyruvate. The sodium hexose diphosphate was prepared from a commercial sample (Winthrop Chemical Co.) of the calcium salt by adding an appropriate quantity of sodium oxalate by filtration. The mixtures were incubated at 37° C. for twenty-four hours, with frequent shaking.

The flasks were then chilled and stored overnight at 5° C. The cells were centrifuged from the solution and the inorganic phosphate removed by precipitation from an ammoniacal solution with 4 ml. of 20 per cent magnesium acetate. The resulting precipitate was removed by centrifuging and 4 ml. of glacial acetic acid and 1.6 ml. of 50 per cent barium acetate were added to the liquid. The solutions were filtered and the filtrates stored at 5° C. At the end of twenty-

TABLE 1.—Phosphorylation of Glucose by Yeast at Various pH's (Four Hours)*

pH	5.4		6.7		8.6	
Trial	Mg./100 Cc. I	II	Mg./100 Cc. I	II	Mg./100 Cc. I	II
pH after incubation	5.28	5.23	5.9	5.81	6.7	6.65
Glucose before incubation	4925	4880	5400	4550	4520	4742
Reducing substances after	2920	2870	1792	1015	1508	1196
Free phosphorus before	540	521	560	598	590	623
Free phosphorus after	360	318	34	82	17	45
Phosphorus esterified	180	203	526	518	573	578
Phosphorus esterified as diphosphate	140	151	472	445	522	494
Hexose diphosphate formed	767	822	2588	2440	2862	2710
Phosphorus esterified as monophosphate	40	52	54	70.8	51	84.2
Hexose monophosphate formed	335	435	453	594	418	704
Per cent phosphorus esterified	33.3	39.0	93.9	86.4	97.1	92.8
Per cent esterified phosphorus as diphosphate	77.8	74.4	89.7	86.3	91.1	85.5
Per cent esterified phosphorus as monophosphate	22.2	25.6	10.3	13.7	8.9	14.5

*In milligrams per cent.

four hours, the barium salt of phosphoglyceric acid began to crystallize. One-ninth of a volume of ethyl alcohol was added to help complete the precipitation. After standing in the icebox for twenty-four hours longer, the precipitate of barium phosphoglycerate was filtered off in dry porous-bottomed crucibles and weighed. The salt may be purified by being dissolved in seventy times its weight of 0.05 normal hydrochloric acid and reprecipitated by adding twice the volume of alcohol. The results obtained in each case are shown in Table 2.

III. DEGRADATION OF PHOSPHOGLYCERIC ACID BY MOUTH YEAST

The next step in the degradation of glucose by enzymes is the conversion of phosphoglyceric acid to pyruvic and phosphoric acids. The promotion of this reaction by beer yeast and by the enzymes of germinating peas and beans has been amply demonstrated by Neuberg and his co-workers.[17] Embden has also shown that the same reaction occurs in the presence of minced muscle.[18] In ordinary yeast fermentation, pyruvic acid does not accumulate in large quantities owing to the presence of the enzyme carboxylase, which decomposes the keto-acid into carbon dioxide and acetaldehyde. However, the rate of reaction can easily be followed by determining the increase in inorganic phosphate which is formed in equivalent quantities.

TABLE 2.—Production of Phosphoglyceric Acid by Mouth Yeast (Twenty-Four Hours)

pH	Trial	Yield of Barium Phosphoglycerate Mg./100 Cc.	
5.4	I	204	6.33 mm./1.
	II	150	4.70
6.7	I	624	19.3
	II	510	15.8
8.6	I	570	17.7
	II	495	15.3

The 3-phosphoglyceric acid employed in this work was synthesized biologically after the method of Ostern and Guthke.[19]

In determining the action of mouth yeast on phosphoglyceric acid, the general methods of Neuberg and Kobel[17] were employed. To 3 gm. of barium phosphoglycerate were added 7.0 ml. of 50 per cent acetic acid and about 20 ml. of distilled water. The resulting mixture was shaken vigorously for about one hour and then centrifuged. The barium was precipitated from the supernatant liquid by the addition of an appropriate quantity of sodium sulfate solution. After the barium sulfate was filtered off, the filtrate was adjusted to the desired pH with sodium hydroxide and then diluted to 35 ml. A final adjustment of pH was made if necessary.

To 25 ml. of the solution of sodium phosphoglycerate prepared as described above was added 2 gm. of dried mouth yeast and 1 ml. of toluene. The mixture was sealed in a large test tube and shaken in the thermostat at 37° C. for twenty-four hours. Control tubes were also prepared exactly as above described except that they contained no organisms. After twenty-four hours' incubation, the tubes were broken open and the yeast cells removed by centrifugation. Protein was removed from the substrate by precipitation with trichloracetic acid and then with alcohol. After this treatment, the solution was analyzed for free phosphate, acetaldehyde and pyruvic acid.

Phosphate analyses were made by the colorimetric method of Martland and Robison, already mentioned. Acetaldehyde and pyruvic acid were determined by the quantitative method of Simon and Neuberg[20]: To the deproteinized substrate was added excess 2, 4-dinitrophenylhydrazine dissolved in 2 N hydrochloric acid. After standing in the incubator for from ten to twelve hours, the mixture was chilled and the precipitated hydrazones were removed by filtration. The hydrazone of pyruvic acid was separated

from that of acetaldehyde by extraction with sodium carbonate solution and the former reprecipitated by the addition of mineral acid. The respective hydrazones were filtered off in weighed, porous-bottomed crucibles, dried to constant weight at 110° C. and weighed. The accuracy of this method was checked and the maximum error found to be about 1 per cent. The results obtained at various pH values are given in Table 3.

IV. REDUCTION OF PYRUVIC ACID TO LACTIC ACID BY MOUTH YEAST

The final reaction involved concerns the transformation of pyruvic acid, the products resulting from this transformation depending somewhat on the conditions. In the ordinary yeast fermentation, the pyruvic acid is acted upon by carboxylase, yielding carbon dioxide and acetaldehyde. The acetaldehyde is then reduced to ethyl alcohol. However, in accordance with theoretical considerations already set forth, the presence of certain calcium salts in the fermenting mixture may so modify the conditions that pyruvic acid is not acted upon by carboxylase, but instead is reduced directly to lactic acid. The identity of the compound which acts as hydrogen donor for this reduction has not yet been ascertained, but it is undoubtedly one of the labile intermediates produced during the glucose degradation.

In the production of lactic acid by muscle enzymes, it seems that phosphoglycerol probably acts in this capacity. However, when acetaldehyde is reduced to alcohol in an ordinary yeast fermentation, this does not seem to be the case. Meyerhof is of the opinion that phosphoglyceraldehyde acts as the hydrogen donor in the case of yeast fermentation, although no experimental proof seems to be available in support of this idea.

In the present work, dried mouth yeast was allowed to act on pyruvic acid in the presence of powdered human enamel and under varying conditions. After incubation, the substrate was analyzed for pyruvic and lactic acids.

Because of the biologic importance of lactic and pyruvic acids, a number of methods have been devised for their quantitative estimation. Some of the more common methods have been reviewed previously[21] and need not be repeated here. Suffice it to say that pyruvic acid was determined by precipitation as the 2, 4-dinitrophenylhydrazone, according to the method of Simon and Neuberg.[20] Other carbonyl compounds, if present, will likewise be precipitated, but the hydrazone of pyruvic acid, because of the presence of the carboxyl group, can be extracted quantitatively from other hydrazones by means of sodium carbonate solution and then reprecipitated by the addition of mineral acid.

Lactic acid can be estimated quantitatively by virtue of the fact that treatment with excess potassium permanganate in sulfuric acid solution results in the production of 1 mol of carbon dioxide. Bamberger and Field[22] have measured

TABLE 3.—Action of Mouth Yeast on Phosphoglyceric Acid (Twenty-Four Hours)

pH	Trial	H_3PO_4 Formed Mg./100 Cc.	$CH_3.CO.COOH$ Formed Mg./100 Cc.	CH_3CHO Formed Mg./100 Cc.
5.4	I	133	33.5	12.4
	II	158	49.7	14.3
6.7	I	169	34.1	9.5
	II	187	51.6	15.6
8.6	I	193	58.7	8.2
	II	211	71.3	9.1

the carbon dioxide thus formed in the Van Slyke gas apparatus. Since the method presents the advantages of being rapid and also capable of accurate determinations with small samples, it was adopted for the work at hand. A Van Slyke apparatus of the manometric type was employed. Pyruvic acid is also oxidized by permanganate under these conditions, but, upon investigation, the reaction was found to be quantitative, so it was decided to determine total lactic and pyruvic acid by this method; then determine the pyruvic acid by precipitating and weighing of the 2, 4-dinitrophenylhydrazone. The lactic acid can then be ascertained by difference.

The first experiment was to allow dried mouth yeast to act on sodium pyruvate in distilled water and in the presence of powdered tooth enamel. No lactic acid was produced under these conditions, and indeed none could be expected, because no compound was present which could serve as hydrogen donor for the reduction. A similar experiment was also carried out in which calcium α-phosphoglycerol was added to the mixture in quantities equivalent to the pyruvic acid present. Some decarboxylation of the pyruvic acid to acetaldehyde and carbon dioxide occurred, but no lactic acid was formed, which indicates that phosphoglycerol cannot serve as hydrogen donor under the influence of the reductases of yeast. That some intermediate can act in this capacity is indicated, however, by the following experiment: A solution of sodium hexose diphosphate was prepared by adding an appropriate quantity of sodium oxalate to a solution of the calcium salt and removing the precipitate of calcium oxalate by filtration. Three grams of pyruvic acid per hundred milliliters was added to this solution and the pH then adjusted to 6.7 by means of sodium bicarbonate. Twenty-five milliliters of this solution was placed in a large test tube and 2.0 gm. of dried yeast and approximately 0.5 gm. of powdered tooth enamel added. A second tube was prepared in the same way except that no yeast was added. A third tube was also prepared which contained sodium hexose diphosphate solution, yeast and powdered enamel, but no pyruvic acid. The latter two tubes served as controls. All three tubes were sealed off with the blow torch and shaken constantly by mechanical means in a thermostat at 37° C. for four hours. After the yeast cells were centrifuged off, the substrate was analyzed for lactic and pyruvic acids. It was found that of the 3.16 gm./100 ml. of pyruvic acid originally present, 2.75 gm./100 ml. was decomposed, production of 1.18 gm./100 ml. of lactic acid resulting. From these results, it appears that some compound arising from the degradation of hexose diphosphate served as hydrogen donor for the reduction of pyruvic acid.

Some previous investigations[21] have demonstrated that hydrogen donors are present in sterile human saliva, which can serve for the reduction of pyruvic acid under the catalytic influence of the reductases of yeast and other organisms. The next experiment was designed for the purpose of determining the rate and extent to which this can take place at various pH's. Human saliva was obtained by paraffin stimulation and sterilized by autoclaving for twenty minutes at 15 pounds pressure. Approximately 2.0 gm. of pyruvic acid per hundred milliliters was added and the pH adjusted to the desired value by means of sodium bicarbonate. Twenty-five milliliters of this saliva solution was pipetted into each of several large test tubes and 2.0 gm. of dried mouth yeast and about 0.5 gm. of powdered tooth enamel were added to each tube. Another series of tubes was prepared in the same way except that calcium glycerophosphate was added in an amount equivalent to the pyruvic acid present. This was done in order to determine whether this compound had any influence on the transformation of

pyruvic acid in saliva medium. Control tubes, prepared in exactly the same way, except that they contained no yeast, were also run in all cases. The tubes were sealed off with the blow torch and shaken in the thermostat for four hours. The substrate of each tube was analyzed for lactic and pyruvic acids and for acetaldehyde. The results are given in Table 4.

COMMENT AND CONCLUSIONS

As a result of this series of investigations, it has been demonstrated that yeast isolated from the human mouth possesses the necessary enzyme system for the promotion of the same intermediary reactions that are involved in the production of lactic acid from glucose by muscle enzymes. It is interesting and important to note that the various reactions occur at rather widely varying rates. With the first reaction in which glucose is phosphorylated, the rate of reaction is very fast, indicating that mouth yeast is very rich in phosphatase enzyme. The second reaction, however, in which phosphoglyceric acid is produced occurs very slowly. The same is also true of the degradation of phosphoglyceric acid to pyruvic acid, while the transformation of pyruvic acid again occurs with fair rapidity.

In view of these facts, it seems reasonable to suppose that if one were to add to the culture of mouth yeast another organism which contained large quantities of the enzymes that are present in yeast to only a slight extent, the rate of acid production would be speeded much more. In other words, a symbiotic effect between the two organisms would be produced. That such a symbiosis may and does occur is indicated by an experiment in which the rate at which tooth enamel is dissolved by the action of yeast and *Lactobacillus acidophilus* on glucose in saliva medium was determined. A pure culture of mouth yeast was found to dissolve 22 mg. of calcium per hundred milliliters in eighteen hours, while *Lactobacillus acidophilus* under the same conditions dissolved only 4 mg. However, a mixture of yeast and acidophilus in eight tests gave an average decalcification equivalent to 45 mg. of calcium per 100 milliliters. This symbiotic effect could undoubtedly be demonstrated with other combinations of mouth organisms.

The experiments carried out in these investigations offer a possible explanation for this symbiotic effect. The phosphatase activity of *Lactobacillus acidophilus* was determined by its ability to phosphorylate glucose under the identical conditions with which the determinations were made with yeast. It was found that *Lactobacillus acidophilus* promotes this reaction extremely slowly, very little phosphate uptake occurring in four hours. As previously noted, yeast can promote this reaction at a very rapid rate. On the other hand, a previous investigation[21] has shown that *Lactobacillus acidophilus* is relatively rich in reductase, as indicated by its ability to reduce pyruvic acid to lactic acid. Thus, when the two organ-

TABLE 4.—Action of Mouth Yeast on Pyruvic Acid in Sterile Saliva Medium (Four Hours)

	Without Phosphoglycerol			With Phosphoglycerol		
pH	5.4	6.7	8.6	5.4	6.7	8.6
Pyruvic acid present	2010	2010	2010	2010	2010	2010
Pyruvic acid decomposed (mg./100 cc.)	491	1510	1230	542	1477	1263
Lactic acid formed (mg./100 cc.)	88	592	501	95	588	311
Acetaldehyde formed (mg./100 cc.)	143	324	91	160	311	79
Per cent pyruvic acid decomposed	24	75	61	27	73	62
Per cent pyruvic converted to lactic acid	18	39	41	17	39	24

isms are combined, the enzymes which are present to only a slight extent in each are made available to the system and the production of acid takes place at a rate which is greater than additive.

Heretofore, most investigators have regarded lactic acid as the compound which is mainly responsible for the decalcification of tooth enamel. If the mechanism for the production of this acid in the mouth coincides with the scheme set forth herein, this idea may require revision. The primary ionization constant for phosphoglyceric acid is 3.8×10^{-2} and for pyruvic acid is 5.9×10^{-3}, as compared to the value of 1.38×10^{-4} for lactic acid. Since the former acids are formed first and are stronger than lactic acid, it would appear that they are the compounds that actually decalcify the teeth. The reason lactic acid rather than phosphoglyceric and pyruvic is isolated from carious material is the ephemeral existence of the latter. As soon as they are formed, the action of enzymes soon converts them into the final product, lactic acid.

As a result of the investigations reported on herein, experimental evidence is available which may serve as a starting point for an explanation of the mechanism whereby lactic acid is formed in the mouth. Consequently, it should throw some light on the problem of the etiology of dental caries. We believe that yeast plays a rôle in this process and that the action of yeast in symbiosis with certain other mouth organisms may give rise, under appropriate conditions, to sufficient quantities of an acid to produce extensive and rapid decalcification of the teeth as is observed in rampant caries. When similar investigations have been carried out on other mouth organisms, it is hoped that it will be possible to predict which organisms and which combinations of organisms are mainly responsible for the decalcification processes.

SUMMARY

1. A method of growing mouth organisms on a large scale has been devised.

2. It has been demonstrated that mouth yeast possesses the necessary enzyme system for the production of lactic acid by the same mechanism that has been observed for muscle enzymes.

3. The rate and extent to which the various reactions can occur have been determined quantitatively.

4. Several "new" acids have been suggested as of importance in the decalcification of tooth enamel.

BIBLIOGRAPHY

1. Miller, W. D.: Der Mikro-organismen der Mundhoehle. Ed. 2. Leipsic: George Thieme, 1892.

2. Black, G. V.: *Tr. Ill. D. Soc.*, 1886, p. 180.

3. Jay, Philip, et al.: Observations on Relationship of Lactobacillus Acidophilus to Dental Caries in Children During Experimental Feeding of Candy. J.A.D.A., 23:846, May 1936.

4. Anderson, T. G.: *J. D. Res.*, 16:489, December 1937.

5. Hansen, H. L.; Fosdick, L. S., and Epple, Charlotte F.: Action of Mouth Organisms on Certain Carbohydrates. J.A.D.A., 24:1611, October 1937.

6. Buchner, E.: *Ber. deutsch chem. Gesellsch.*, 30:110, January 1897; 31:568, March 1898.

7. Meyerhof, O.: *Biochem. Ztg.*, 292:25, May 1937.

8. Wood, H. G.; Stone, R. W., and Werkman, C. H.: *Biochem. J.*, 31:349, March 1937.

9. Meyerhof, O.: *Nature*, 132:373, September 1933.

10. Harden, A.: *Biochem. J.*, 19:477, April 1925.

11. Fosdick, L. S.: Carbohydrate Degradation by Mouth Organisms. I. J.A.D.A., 26: 415, March 1939.

12. Stephan, R. M.: *J. D. Res.*, 17:251, June 1938.

13. Kay, H. D.: *Biochem. J.*, 22:855, April 1928. Kutscher, W., and Wörner, A.: *Ztschr. f. physiol. Chem.*, 239:109, 1936.

14. Cahn, T., and Houget, J.: *Ann. de physiol. et physiochem. Biol.*, 9:205, 1933.

15. Harden, A., and Henley, F. R.: *Biochem. J.*, 21:1216, September 1927.

16. Martland, M., and Robison, R.: *Biochem. J.*, 21:847, July 1926.

17. Neuberg, C., and Kobel, M.: *Biochem. Ztg.*, 263:219, May 1933.

18. Embden, G.; Griesbach, W., and Schmitz, E.: *Ztschr. f. physiol. Chem.*, 93:1, 1915.

19. Ostern, P., and Guthke, J. A.: *Ztschr. f. physiol. Chem.*, 248:155, 1937.

20. Simon, C., and Neuberg, C.: *Biochem. Ztg.*, 232:479, 1931.

21. Fosdick, L. S.; Hansen, H. L., and Wessinger, G. D.: Reductase Activity of Various Mouth Organisms. J.A.D.A., 24:1445, September 1937.

22. Bamberger, J. P., and Field, J.: *Proc. Soc. Exper. Biol. & Med.*, 25:87, October 1927.

SUPERNUMERARY TEETH

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SUPERNUMERARY teeth may be present in the deciduous as well as the permanent dentition. Past investigators held the opinion that supernumerary teeth are present only in the permanent dentition, but recent findings prove this to be untrue, many cases having been reported in the so-called first dentition.

Study of the development of supernumerary teeth, discussed frequently by various authors, calls to the attention the question of the genesis of these teeth. Various theories have been advanced. Some have explained the development of supernumerary teeth as occurring by the division of the *Zahnanlage*. Others profess their belief that supernumerary teeth are atavistic. The latter theory has been disproved by the absence of the supernumerary cuspid and the fact that supernumerary teeth are found in the deciduous dentition. These facts make it possible to accept the theory that the supernumerary teeth are developed by abnormal proliferation or hyperactivity of the dental laminae. Röse asserts that all epithelial remnants in the jaw may be able to develop a tooth under unknown stimulating conditions. This accounts for the fact that, in very rare cases, the dental strand may not be absorbed, but may continue to produce tooth buds indefinitely. Zukerkandl reported that about 3 per cent of crania examined by him were found to contain enamelless tooth rudiments in the incisor region.

Supernumerary abnormalities are found more frequently than those due to the complete absence or the failure of development of the tooth bud. Supernumerary teeth may be found embedded or erupted, and they may have no resemblance to normal teeth. More frequently, however, they have a tendency to develop the form of the teeth around which they are found. The supernumerary teeth may be in direct alinement with the remainder of the arch, in occlusion, or they may be crowded or bunched lingually or buccally in quite definite malocclusion. Frequently, particularly around the upper central incisor region, their eruption has a tendency to force the incisor teeth out of line. These supernumerary teeth may be normal, peg-shaped or tuberculated.

There are definite favorite locations for the development and eruption of these "extra teeth." The median line of the upper and lower jaws is probably the most frequent site, the regions of the molar teeth being next, followed by the, more rare, areas of the bicuspid regions. We understand therefore why supernu-

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merary teeth can take the form of incisors, bicuspids and molars. The fact that supernumerary cuspids are never found substantiates the theory of the genesis of the development of these abnormalities.

Although supernumerary teeth are not uncommon, the following case report seems to be justified because of the unusual and rare occurrence of five embedded normally developed lower bicuspids, three on the left and two on the right side.

CASE REPORT

A youth, aged 18, height 5 feet 11 inches,

Fig. 1.—Three impacted unerupted supernumerary mandibular bicuspids on left side.

Fig. 2.—Two impacted unerupted supernumerary mandibular bicuspids on right side.

weight 155 pounds, had had a roentgenogram made of the lower left bicuspid region, the picture revealing three supernumerary bicuspid teeth located definitely below the gingivae and immediately between the roots of the normally erupted teeth. (Fig. 1.) A history was given of an erupting lower third molar causing a pericoronitis; also a slight tightness, on rare occasions, existing around the bicuspid area.

Full mouth roentgenograms were taken and two more supernumerary embedded bicuspids of like character were found on the right side. (Fig. 2.) There were no clinical manifestations on either side of the jaws. The face and jaws were normal and symmetrical. The mandible was not enlarged in this region and gave no indication that three well-formed crowns and partially formed roots were contained therein.

The intra-oral and roentgenographic examinations showed that the erupted teeth had well-formed roots and crowns, with good occlusion and perfect contact. An occlusal picture disclosed that on the buccal and lingual aspect there was no bulging whatsoever.

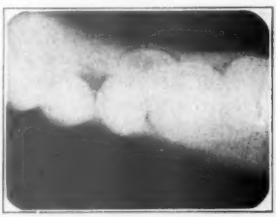

Fig. 3.—Occlusal view of Figure 1 after two bicuspids were removed, showing relationship of remaining bicuspid to lingual plate of mandible.

Fig. 4.—Two inverted, unerupted, tuberculated teeth in upper central region.

Operation was performed under block anesthesia, using a large mucoperiosteal flap. The cortical plate gave no evidence as to the location of the embedded teeth. The outer plate of bone was carefully removed, care being exerted to preserve the bony structure supporting the erupted teeth, as the supernumerary teeth were located directly between the roots of the bicuspids and first molar. The tooth found between the first and second

bicuspid had to be divided on removal in order to preserve the structure of the bone. The supernumerary tooth toward the buccal side, between the first molar and second bicuspid, was removed in its entirety. The remaining tooth being situated more lingually than the adjacent one, subsequent operation was necessitated. (Fig. 3.) The later operation was performed in order to allow regeneration of bone. The tooth was later removed, from the lingual side. Healing was uneventful.

Another case is reported of two supernumerary embedded teeth with tuberculated crowns in the upper incisor region of a 9-year-old girl. These teeth slightly resembled in formation bicuspid and molar teeth. The condition was no doubt due to the deep fissures of the tubercles. The left supernumerary tooth was inverted and its large apical foramen was separated from the mucous membrane by a thin layer of bone. These teeth not only impeded the eruption, but also caused rotation of the permanent central incisors. (Fig. 4.)

Tuberculated supernumerary teeth are characterized by greater or less development of cusps. Since we know that supernumerary teeth frequently imitate in shape the teeth around which they are found, the presence of a tuberculated tooth indicates a differentiation in the direction of multicuspidated teeth.

The fact that the inverted as well as the other supernumerary tooth was embedded might indicate that retention was caused by a lack of tendency of these teeth to erupt, because of their malformation and displacement. No clinical obstacles can be considered in this case.

The general tendency in cases of supernumerary teeth with no definite clinical symptoms is to be conservative in treatment until the symptoms warrant removal. In the first case (Figs. 1-3), the position of the embedded supernumerary teeth was such that their continued development would cause sufficient pressure on the erupted teeth to produce malocclusion or resorption of the root surfaces.

The removal of the supernumerary teeth in the second case (Fig. 4) was indicated in order to allow the eruption of the permanent central incisors. In such cases of inverted unerupted teeth, with their root apex in close proximity to the mucous membrane of the mouth, there is a possibility of bacterial invasion. Infection can quickly extend into the deeper tissues via the existing large apical foramina.

BIBLIOGRAPHY

1. Röse, C.: Ueber die Rueckbildung der seitlichen Schneidezaehne. *Deutsche Monatschr. f. Zahnheilk.*, 1909.

2. Zukerkandl, E.: Makroskopische anatomie. *Scheff's Handbuch d. Zahnheilk.* Vienna: Urban & Schwarzenberg, 1929.

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ARE TEETH INSURABLE?

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ALMOST everything can be insured today against almost every form of damage or total loss. Data have been compiled so that the law of averages can be quite accurately predicted. Teeth are insurable against damage and loss if we have sufficient statistical data to set up a law of averages. Tooth insurance, like any other insurance, to be safe must have a large number of insured in order to spread the risk.

Many excellent papers have been written on the subject of dental conditions as revealed by clinical and x-ray studies. Many surveys have been made and published about the dental condition of the school child. Statistical data are available to determine the eruptive ages for the various permanent teeth and the variations of these ages according to sex. All this information is of value, but it does not give us the necessary data to determine to what degree caries and its resultant damages can be controlled or possibly prevented; nor does it give us the time required to render these preventive services.

The purpose of this paper is to present statistical data compiled over the past twenty years by accurate record keeping to determine the average amount of time needed annually to care for children up to and including the twenty-first year. The time consumed in orthodontic treatment, complicated extractions and oral surgery has not been included because this work was referred to dentists practicing these specialties. All other services common to the practice of children's dentistry are the basis upon which this information has been compiled.

For no particular reason, 110 children were used in the first survey, which began in 1920 and was published in 1930.[1] It is necessary for us to reconsider this information as it is a part of our more recent studies, which now allow us to predict a law of average for dental care for the first twenty-one years of these children's lives. The case histories that furnish us the information for both the first and the second survey were not selected, but were included only upon the basis of continuous services at regular intervals.

From Table 1, it is evident that considerably more time is needed to care for a child who has dental caries than for the child who first visits a dentist at 2 years of age, and before there is any evidence of caries. It has been my observation that rarely does caries manifest itself in the first two years of a child's life unless there are some physical abnormalities or irregularities, a case of dietary neglect or extreme oral uncleanliness. The seventy children with caries (Table 1) were beyond their second year. They did not have extensive caries, but did average five plus cavities per mouth. A few needed root canal treatment in the deciduous teeth. After proper dental treatment, their mouths were considered in excellent condition, but the follow-up care was found to average forty more minutes a year than that of the children whose mouths were caries free. This seems to prove the old adage that "one bad apple in a box will spoil all the rest of the apples in the box." It would also prove that dental caries is spread from one tooth to another in the same mouth.

After careful consideration of the information presented in Table 1, it was decided to accept a limited number of child patients on an annual charge basis. January 1, 1932, the work was started, and eventually the parents of about 125 children availed themselves of the service. The annual charge was based upon an anticipated service of an average of two hours a year for a period of about ten years, or until all the deciduous teeth had been replaced by their successors. In any event, it was understood that at 12 years of age this annual service would be terminated. A few children were accepted on an annual service charge after 2 years of age, for, upon examination, it was decided that their mouths were in a very acceptable condition, having received dental attention.

It was anticipated that the annual follow-up care of 1-7/12 hours as shown in Table 1 would be slightly higher since x-ray services had not been included and there had been no experience with fractured anterior teeth; but these services were to be included in the annual charge. Over the past seven years (1932 to 1939), this annual charge service has been rendered and the anticipated increase has been justified to a point where one can definitely make the statement that children, beginning at 2 years of age, will, for the next ten years, on an average need twenty hours of dental service, not including orthodontia or oral surgery. It is important that the child pay a visit to the dentist regularly every ninety days and that the dentist be qualified to practice children's dentistry of the highest quality in the minimum amount of time.

In order to conserve time, the dentist's ability to manage children must be developed to a high degree. Every technical procedure must be routinely developed to assure a most satisfactory result in the least possible time. The parent and child must be trained in home care of the mouth so that the mouth and teeth will always be in a healthy condition, thereby helping to reduce the incidence of dental caries and all other mouth infection. There must be complete harmony and cooperation between parents and dentist.

Table 2 presents our latest studies of 110 children selected under the same conditions as those selected for our earlier studies, but for a period of twenty years, or from 2 to 22 years. Orthodontia, extraction and oral surgery have, as previously, been referred to specialists in these fields, so that figures are not available for these particular services.

It is interesting to note that the maximum number of operating hours for any one child is an average of 6¼ hours a year for fourteen years, while the minimum is 1-1/10 hours a year. In order to arrive at an accurate figure and to establish a true average, larger groups should be

TABLE 1.—AVERAGE COST OF CHILDREN'S DENTISTRY (AGE 2 TO 12)

	Average	With Caries	Without Caries
Number of children	110	70	40
Average number years cared for Maximum Minimum	6.45 10 5	6.45	6.45
Time consumed on first visit (hours)	2 1/12	3 1/12	1/3
Follow-up care per year (hours)	1 7/12	1 5/6	1 1/6
Initial repair and follow-up (hours)	1 11/12	2 1/6	1 1/4

studied over long periods of time. The average number of hours a year for twenty years of dental services is 2¾ hours, giving a grand total of fifty-five operative hours.

We have determined that it takes twenty hours to care for the child's mouth up to 12 years of age; therefore, subtracting twenty hours from the grand total of fifty-five hours, we know that the adolescent period of ten years from 12 to 22 will take thirty-five hours of dental services.

We must utilize this information with extreme discretion, since all of the 110 children who qualify for our latest studies have had regular and constant dental care nearly all their lives. We cannot apply our second law of average to any and every child 12 years of age unless that child has had the proper dental care in his earlier years.

Approximately one third of the group studied needed orthodontic treatment, and these cases show a slightly higher annual average for operative services. No doubt, this total additional time of 1⅔ hours was needed after 12 years of age, during the time or shortly after orthodontic appliances had been in the mouth.

In twenty-six children, or about one fourth of the whole group, the teeth were filled with plastics, silicious cements and amalgams because their parents demanded this in view of the lower cost, and through lack of appreciation of a higher type of dental service.

The choice of filling material to be used in the teeth of the remaining eighty-four children was left to the operator. Our selection was gold foil, gold inlays, a few silicious cements and an occasional pit filling of amalgam, which had been placed in the earlier years of the child's

TABLE 2.—AVERAGE COST OF DENTISTRY (AGES 2 TO 22)

Number of children		110
Average number of years cared for		13
Maximum	18	
Minimum	10	
Average present age		18
Maximum	23	
Minimum	15	
Average number of hours a year		2 3/4
Maximum	6 1/4 (for 14 yrs.)	
Minimum	1 1/10 (for 13 yrs.)	
Type of dentistry — plastics only	(Silicious cements) 26 — Amalgams	
plastics and gold	84	
Number lost permanent teeth	2 (by accident)	
Number of fractured anterior teeth		9
Vital	6	
Non-vital	3	
Number of cases treated by orthodontist		38
Extreme	4	
Average	31	
Simple	3	
Average number of hours a year for operative dentistry in this group of 38		2 5/6

life. These small amalgam fillings are giving adequate service and I have no reason for their replacement.

The averages determined by the information obtained from Tables 1 and 2 are naturally influenced by the speed of operation or the technic and the knowledge of the operator. There need be no variation in the knowledge or understanding of the operator for there is available to every dentist, through our colleges, THE JOURNAL, the *Review of Dentistry for Children* and many other dental publications, and our national, state and county meetings, adequate information on the practice of dentistry for children.

The speed of operation naturally will be determined by the technic that is selected. Some technical procedures in the practice of operative dentistry for children have excellent results, but consume two to three times as much time as other technics.

Time does not permit a detailed discussion of child management and operative dentistry for children, but all of these technical procedures have been published.[2]

CONCLUSION

Equitable arrangements can be concluded between parents or guardians of children and the dentist by which the latter renders services incidental to (1) prevention of caries, (2) eradication of caries and repair of the damages inflicted thereby, (3) restoration or replacement of parts of or whole teeth affected by accidents and (4) extraction and orthodontic treatment, on a basis of periodic payments, previously agreed on, provided (a) such arrangements are complete with a sufficiently large number of patients to ensure that the services rendered the whole group will conform to the predetermined work-time factor; (b) satisfactory cooperation between the patient, his family and the dentist is obtained, through which home care is maintained and visits for inspection are made as often as is required for the individual case, and (c) the operator is diligent in his efforts to prevent beginning caries and to detect and correct each attack in its earlier stages.

Among the advantages to the recipient are early assurance that the major costs of dental service will not be beyond a predetermined amount, and the shifting of the responsibility for a clean, healthy and comparatively caries-free mouth to the person who should, but cannot ordinarily, assume the obligation.

Among the advantages to the dentist are a "leveling off" of the hills and valleys of his income, an income related to the value rather than the amount of service rendered and the satisfaction of knowing that his services are being rendered to the maximum advantage of all parties concerned.

BIBLIOGRAPHY

1. SWEET, C. D.; WATSON, R. G., and STAFFORD, H. E.: *J.A.M.A.*, 94:544-546, February 22, 1930.

2. SWEET, C. A.: Child Management Through Pain Alleviation. J.A.D.A., 25:1447, September 1938.

Home Care of Children's Mouths. *Pub. Health News*, November 1931; January 1932.

Procedure for Treatment of Exposed and Pulpless Deciduous Teeth. J.A.D.A., 17:1150, June 1930.

Classification and Treatment of Posterior Teeth. *D. Digest*, 42:14, January 1936.

Cavity Preparation for Deciduous Teeth. *D. Digest*, 41:148, May 1935.

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PROBLEMS IN DENTAL EDUCATION

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DENTAL EDUCATION AND THE DENTAL PROFESSION

THE years 1839 and 1840 are marked by three historic events for dentistry: (1) the establishment of the first journal of dentistry; (2) the organization of the first national association of dentists, and (3) the founding of the first college of dentistry in the world. One hundred years ago, then, provision for the education of men and women to render dental service constituted a significant part of the effort to raise the status of dentistry and place it among the professions. Continually, since then, dental education has been considered by the leaders of dentistry as indispensable to the progress of their profession.

It is apparent, therefore, that the problems of dental education cannot be regarded as of interest only to dental educators. True enough, they are dealt with more especially by deans and teachers of dental schools, but it is of great importance both to dentists and to the public that dental schools be thoroughgoing educational institutions the graduates of which take honorable places in the profession and minister well to dental health needs. There can be no such thing as a great profession without great professional schools. A weakness in the means of professional education is at once reflected in the profession itself, for the profession becomes largely what the schools make of it through educating its members.

From their beginnings in America, dental associations have recognized this fact and have devoted attention to professional education in dentistry. The initial meetings of the American Society of Dental Surgeons, of the American Dental Convention and of the American Dental Association considered questions of dental education, as well as questions of professional conduct and service. In fact, one of the principal purposes in organizing dental societies in the United States was to deal with this matter. Organized dentistry may well continue this interest because the training provided may be instrumental in bringing about great changes in dental practice.

From this statement of the dentist's interest in dental education, we turn to some of the major issues and problems before the dental schools and those who are interested in the education of practitioners. There are many of these problems; we shall consider only a few.

OBJECTIVE OF DENTAL EDUCATION

First, there is the question as to what shall be the major objective of dental education, particularly of undergraduate education. Obviously, the principal purpose is to prepare men and women for the practice of dentistry. But this answer is far from complete. One must consider what kind of practitioner the student is to become.

In the various discussions one hears, two points of view are evident. One of these emphasizes technical training and the ability to perform dental operations.

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In the development of dental education, the program has been dominated by this objective. The outcome has been numerous technics and systems of doing things for patients, and high proficiency on the part of many dentists in all kinds of dental restorations. The technics were not generally based upon scientific principles, but were rather the outcome of trial and error in experience. Furthermore, only minor attention was given to the biologic basis of the operations. The emphasis was definitely on technical perfection in restorations. The result has been the development of technical skill unsurpassed, if equaled, anywhere else in the world. And America has been proud of it. Moreover, many men and women from across the seas have come to us to learn from the masters how to do the finished work for which American dentistry is famous. This point of view is reflected in the dental schools in the many hours devoted to technical work in the laboratories and in the large number of operations on patients required of students in the dental clinics of the schools.

The other point of view looks upon dental technic as but a means of meeting the needs of patients. It definitely regards dentistry as a health service which is rendered only as technical service is properly related to the individual. One who proposes to practice dentistry on this basis must obviously know much about the patient; about his health, his well-being, and how these may be preserved through the service the dentist is able to render him. A scientific and medical background is essential to the dentist who proposes to practice on this professional basis. True enough, he must be technically competent, but his ability must reach beyond this attainment, to sound diagnosis and to the ability to plan and execute treatment, both preventive and curative, which meets the health as well as the esthetic needs of the patient.

For various reasons, this second point of view has been gaining ground in dentistry during the past quarter of a century, and it is definitely reflected in the dental schools, largely by the increasing time devoted to science. It is at this point that dental educators are finding one of their most difficult problems; that is, how the desirable objective of preparing competent dentists can be met within a reasonable amount of time. Reference will be made to this point later.

The future progress of dentistry will depend largely on the success of the dental schools in preparing men and women to render service on a professional basis rather than on the basis of technic. This higher goal characterizes the professional school in contrast with the trade school.

RELATION TO MEDICAL EDUCATION

The second major problem in dental education concerns the relation to medical education. On this point, we have all sorts of proposals, ranging from a complete isolationist point of view to a complete integration of dental and medical education. Every one who has an understanding of the functions of medicine and dentistry knows that in the interest of the public good, as well as in the interest of both professions, these two important health services must be related in practice. It is highly desirable, therefore, that medical and dental schools develop cordial relations and coordinate their programs. This is not to say that preparation for one branch of service shall be placed under the other. In the light of the different functions to be performed by the two professions and the requirements of training for each, the subordination of one to the other finds few intelligent advocates. But neither field of education can afford to do without the other, if for no other reason than its own interest. No one can maintain today that a physician who lacks understanding of the objectives and methods of dental service is competent to serve his patients; nor can one take the position that a dentist can serve his patients adequately unless he compre-

hends the relationships of dental service to medical service and is competent to cooperate with physicians as may be required in the practice of his profession.

Both dental and medical schools are making some effort to coordinate their training. The basic sciences are receiving increasing attention in the dental curriculum. Dental schools are effecting connections with general hospitals and are providing courses in diagnosis and dental medicine and in other subjects which bear directly on medico-dental problems and relationships. A few medical schools—all too few indeed—are taking cognizance of their responsibility in this matter by making definite provision for instruction in such subjects as oral pathology, dentistry and medicodental relationships, and, in a few instances, some effort is made to develop these relationships in the school medical clinics.

INSTRUCTION IN DENTAL TECHNIC

Another problem that is troubling some dental educators is the place which instruction in dental technic shall occupy in the dental curriculum. The extensive development of the technical aspects of dentistry, together with the increase of knowledge in this field, raises the question as to how far dental schools shall proceed in training their students in the various forms of dental restorations. It is not possible to give the student training and experience in every form of dental restoration and treatment. The only way out of the difficulty seems to be to formulate more clearly than has yet been done the essential principles of this instruction and to illustrate their application to a sufficient number of cases to enable the student to master any new type that may be developed. There simply is not time to do anything more in the four years devoted to the study of dentistry.

It may be noted in passing that determined efforts will have to be made to reduce the time devoted to mechanical activities on the part of the student, but this must be accomplished in such a way that his training in this field will not suffer. At present, the dental schools are seriously handicapped in dealing with this matter because it is customary for each teacher to be a protagonist for a system of technic rather than an expositor of the principles involved. In all charity, it must be said that, although systems of operations have been useful, they have all too often diverted attention from more basic considerations. What appears now to be sorely needed in this field is a scientific attack on the whole field of operations in restorative dentistry, with the idea of analyzing and formulating the principles and intelligently applying them. No doubt, the new courses in dental materials will be of assistance, but they do not in themselves reach far enough to accomplish this purpose. It is highly desirable that at least some of the better equipped and well supported dental schools devote special attention to the solution of this problem. Perhaps special grants and appropriations will have to be obtained for this purpose, since the field of investigation is extensive.

THE SCIENCES IN THE DENTAL CURRICULUM

Another problem of dental education is: How can the sciences be properly integrated in the dental curriculum? This problem is becoming more difficult every day because of the rapid increase of knowledge pouring forth from hundreds of research laboratories. The undergraduate course in dentistry cannot possibly, in justice to the student, include all that is known, for example, of the histology and pathology of tissues. The effort, then, must be directed toward the proper selection of the material from the sciences in the light of the objectives of the training that is given. To this, practically every one would subscribe, but when it comes to working out the details, there is at once serious disagreement. Each teacher wants

to make specialists in his particular science. Too frequently, he is so immersed in the details of his subject that he has no broad prospective or comprehension of the relationships of his work to the major goals of the dental student. Or one may find teachers at the other extreme who look upon the sciences in the dental curriculum as merely a hurdle to be overcome by dental students, a formality imposed for the sake of making dental education appear respectable; with the result that they offer courses which provide a mere smattering of learning.

Somewhere between the two extreme points of view, sound practice is likely to be found. Students will have to be trained thoroughly in the fundamental principles of these subjects, and their study must proceed to the point where thinking in terms of scientifically established principles becomes habitual. It is one thing to learn a fact or a principle sufficiently to recall it for an examination and to understand it sufficiently to follow a discussion; but it is quite another matter to learn that fact or principle to the point where it is used constantly without conscious effort. Nothing less than such thorough mastery of the fundamental principles of science is adequate for the intelligent and scientific practice of dentistry.

Such a mastery requires more instruction and time than most dental schools now give to these subjects. It requires also the development of certain instruction, such as the principles of medicine and scientific diagnosis, now receiving all too little attention. Clinical teachers must be found who can and do exemplify scientific rather than empiric practice, who constantly illustrate and demonstrate to the students how the principles of science are applied to the diagnosis and treatment of cases and the maintenance of health. In other words, science must be an integral part of clinical practice in the dental school, so bound up with it that there can be no separation in the mind of the student.

SOCIO-ECONOMIC RELATIONS

One of the major issues in dentistry today is the socio-economic problem. It is beyond the province of a layman to attempt to solve this problem. Any observing layman, however, has grounds for believing that important changes are impending in the relationships of the health service professions to the public. The one feature that is disconcerting at the present time in all discussions of the problem is that so much of it is based upon emotion rather than fact and reason. As one studies the pros and cons of the debates, he can hardly escape the conclusion that the heat exceeds the light.

This subject is one which dental schools can no longer afford to neglect. At present, most of the schools offer instruction in dental ethics, jurisprudence and practice management, but practically none provide courses in the broader socio-economic problems of the dental profession. While it is true that the teaching of this subject presents difficulties, the time has come when a bold attempt must be made to give the future dentist some comprehension of these problems and the proposals and plans under consideration. Such instruction is necessary to develop a vigorous and enlightened leadership in these matters.

IMPROVEMENT OF DENTAL TEACHING

A problem which has in recent years had some consideration is: How can better teaching be had in dental schools? There is reason to believe that the teaching has not kept pace with the demand for improved dental training and with the increasing knowledge about teaching. There are several reasons for this situation: First, for a large proportion of the members of dental faculties, teaching is a sideline, an incidental activity, pursued on a part-time basis. No doubt, the practitioner who devotes some time to teaching can and does render useful service to the dental school, but just what his place should be is open to much question. It is

doubtful indeed whether one for whom teaching is a minor or casual, rather than a principal, interest can possibly give it the time and attention which the work demands if it is to be well done and to keep pace with educational development. Certainly, no dental school of the future will be able to rely principally upon part-time teachers. A second reason for the lack of rapid improvement in teaching is found in the conditions surrounding teaching in dental schools, such as the lack of security in tenure, the disrespect in which teaching is often held by practitioners of dentistry, and the lack of incentives to teachers to improve their work. Finally, the means for preparing dental teachers have not been well developed. Some plans have been made and some money has been spent on their development, but the outcome has not been entirely satisfactory.

I wish to digress somewhat to discuss briefly the essential elements of the teacher's equipment, by way of emphasizing the problem of securing good teaching.

When one considers the equipment that a teacher must possess, he usually thinks of scholarship; that is, a mastery of the knowledge and skill to be taught. This equipment is essential. Without it, we have the blind trying to lead the blind, the ignorant attempting to direct others who are likewise ignorant. It is not enough, however, that one shall know only the subject matter he teaches: he must have gone far beyond this point. In fact, he must have proceeded to the place where he has attained a broad perspective, where he comprehends what he teaches, in its various relationships. He must have reached the point where he is not a mere imitator or dealer in second-hand wares, but speaks in his own right and stands on his own feet.

Moreover, it is not enough that the teacher has stored away a vast amount of knowledge: he must be able to do something with it, to make something out of it, to add to it. It has been well said that there are two types of mind in teachers. One is the warehouse mind—perhaps better, the museum mind—in which are stored packages of information that are brought out and exhibited from time to time to students. Some time ago, I heard a college teacher say that he simply could not understand why students no longer flocked to his classes as they had done twenty years before when he was giving exactly the same lectures. He had stored away knowledge in a warehouse and annually he took it down from the shelves, dusted it a bit and passed it out to students, all the time wondering why they failed to display enthusiasm for his wares now grown ancient.

The other type has been called the factory mind, teachers who receive information and accumulate data, not for storage purposes, but as raw material out of which they may create something. Here, we have the student, the scholar, the creative artist. He has the magic touch of the master who opens the eyes of his students and gives them a view of the promised land. What an experience it is for the student to meet this kind of teacher! And how the dental profession should cherish these real scholars who teach the dentists of the future!

Let there be no mistake about it: Teaching is creative work which calls for broad and profound scholarship. In concrete terms, what does this mean for dental teachers? It now begins to appear that the better dental faculties will consist of men who have a broad general education, who have made highly creditable records in their undergraduate dental study and who have gone on to the attainment of masters' degrees, and some, perhaps many, will have become doctors of philosophy. I refer to degrees not as things of value in themselves, but merely to indicate the types of achievement at which we should aim for teachers.

Some one may inquire as to whether actual practice in the profession should not be regarded as important, particularly

for teachers of what are generally regarded as the more distinctly dental subjects. The answer is "yes," but with the qualification that such experience is not enough. It cannot satisfy the need for systematic study on the graduate level. It is now commonly accepted in academic circles that one who is engaged as a teacher should have proceeded from two to four years beyond the educational stage of his students. Is this too much? The dental profession and the public cannot afford to be satisfied with less.

Another aspect of the teacher's equipment is an acquaintance with pedagogic method and considerable skill in its use. Teaching is not such a simple matter as pouring water from one vessel into another; far from it. Even with the most careful training, people find teaching an undertaking of no mean proportions, and some of them cannot do it at all. Many failures in teaching are due to the use of poor teaching methods.

A third aspect of the teacher's equipment is what, for want of a better term, we call personality, an elusive element that defies definition, the combination of high-mindedness, quickness of mind, sympathy with people, altruism in personal relations, enthusiasm for one's task, high standards of achievement, power of vivid presentation and the gift of common sense—all these and many other desirable personal traits.

These three aspects of the equipment of a good teacher—scholarship and skill in his subject, acquaintance with and skill in the use of sound teaching methods and a pleasing and inspiring personality—are among the qualities that must be possessed by the dental teachers of the future.

ADMISSION OF STUDENTS

Another of the problems of dental education is: Who shall be admitted to the schools to study dentistry. This problem deserves more attention from the profession than it has had. The requirements for admission have steadily risen over a period of years until they now include two years of study in college and a rather heavy prescription of science. These technical requirements are therefore on a high level—certainly high enough for the present and the near future. But the requirements of themselves are by no means sufficient to assure satisfactory dentists for the future. More attention must be devoted to high character and those other personal qualifications which make applicants desirable additions to the profession, men and women who can contribute to its prestige and honor and become true examplars of a liberal calling. Except in a few dental schools, the selection of students is now almost entirely on the basis of their meeting the hour requirements of college work. A few schools add certain quality requirements. In general, however, it may be said that practically any one who has had the required amount of college work can secure a place in some dental school. This condition will continue as long as the places in the schools are not all taken; that is, until the number of applicants exceeds the number who can be accommodated, there will be very little selection of students on any other than a mechanical basis. One hope lies in increasing the number of applicants and limiting the number who will be admitted.

Dentists may be helpful at this point. Their advice is frequently sought by youth who are considering dentistry as a career. High schools often request dentists to speak to their students on this subject, and vocational advisers seek counsel from dentists in order that they may direct the thinking of pupils who are confronted with the problem of their life work.

The dentist whose counsel is sought in this matter has a responsibility both to youth and to his profession. He should be well informed on the questions which enter into the choice of a profession, and he should be able to take an objective view of the problems presented by the youth.

He should be interested in: (1) recruiting for dentistry a select group of young men and women who will be an honor to his profession and (2) discouraging all others from choosing dentistry as their life work. This is precisely what many dentists are now doing. The requests from dentists for literature on dentistry as a career are evidence that many take seriously this responsibility.

OTHER PROBLEMS

Such are some of the problems now confronting the dental schools. Others could be mentioned, among which are: how shall the dental schools be rated and accredited; how can the schools engage more extensively in research; how can better relations be developed between the schools and the dental licensing boards; what need is there for graduate education in dentistry and how can it best be met; what short courses and extension study should be provided for practitioners; and how can the dental schools obtain greater financial support.

THE PROFESSION AND IMPROVEMENT OF ITS SCHOOLS

What can dentists do to promote improvement in their professional schools?

The first thing that they can do is to interest themselves in the trends and problems of the institutions. Dentists should be informed as to what is taking place in the schools. They should learn something about the changes in the course of study and methods of teaching to keep the training up to date. They should want to know not only how many students are enrolled but also what kind of men and women they are. Dentists should also ascertain what adequate programs of training cost and whether the dental schools have sufficient financial resources to provide the education that is required. So large are the problems and so vitally are they related to the profession and its service that programs of dental conventions should give a prominent place to these questions.

Second, the practitioner can give moral support to dental education by adopting a favorable attitude toward teaching in dental schools. It must be admitted that, at present, this attitude is not always wholesome. The dental practitioner might well encourage some of the most gifted and competent young dentists to pursue a career of teaching and research. He might promote a policy which will guarantee to such men reasonable comfort and security so they can devote themselves freely to the advancement of the profession. Dentistry can hope to advance only if many of its ablest men devote themselves to educational problems. The schools must have more whole-time teachers who will become expert in the art of teaching.

Third, dentists, both individually and collectively, need to promote the financial support of dental schools. Dental training has become costly, and the demands upon it are increasing. There is a spirit of reform in this field of education, which is requiring larger and better administered libraries, more extensive laboratory and clinical equipment and more well-prepared and expert teachers. The professional training of men and women to serve the public adequately cannot be fully supported from the contributions made by students in the form of tuition and fees from the earnings of the school clinics. New resources must be found to provide the facilities for further progress.

Here, dentists can be of great help. A few have means and could make substantial contributions, while others can assist in other ways. It is through practitioners that the public comes into contact with dentistry. They can promote public interest in dental education if they wish to do so. They are taxpayers, and through their private contacts, as well as through their organizations, they can exert the necessary influence over officials who make and control appropriations from the public treasury. Also, dentists have access to wealthy citizens who are interested in us-

ing their means to promote the public welfare, particularly the health of the people. Why should they not influence these citizens to endow dental education and dental research? And why should not organized dentistry adopt a policy of promoting public understanding of the needs of dental education with a view to obtaining increased financial support for it?

CONCLUSION

On dental education, more than on any other single factor, rests the future of the profession. When the dental schools have the vision to see their service to the profession and the public in terms of human needs and to train men and women adequately to meet those needs, and when the schools are adequately supported so that they will be able to forge ahead in adapting their programs to the expanding view of dentistry as a great health profession, then, and then only, may we look forward with assurance to a profession whose members may justifiably take pride in being a part of it.

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THE PHYSIOLOGY OF MASTICATION

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IN the individual, structure produces function; in the evolution of the species, function produces structure. Nowhere is this law more aptly demonstrated than in the evolution of the masticatory function and apparatus.

Back in the dawn of the world lived a small hydroid animal, the obelia. It consisted of a cylindrical sack with a large opening. The lining membrane of the sack contained scattered digestive cells. The entire animal was an example of a primitive mouth. In fact, the animal was all mouth.

Eons later, there had developed a fish-like animal, the ostrocaderm, which had a mouth opening into a gastro-intestinal tract. It, however, had no jaws or teeth, but sucked small animals into its mouth and swallowed them for digestion and utilization. As the ostracoderm attacked larger and larger animals, it began to use its boneless lips for conflict, and later specimens unearthed by paleontologists have dense face plates armoring their faces, with hard jagged edges around their lips for attacking and holding their prey.

The primitive fish and sharks of the Devonian and Silurian eras developed, from these derm plates, external jaws carrying teeth of styloid shape, for the spearing and holding of smaller fish. These animals lay in wait for their prey, with mouth opened wide. When some smaller animal swam within range, the jaws snapped shut, pierced and held the animal, while areas of dermal teeth in the palate and floor of the mouth macerated and killed it. In these fish, an internal jaw was already forming to augment the action of the external plates.

As the water began to recede from the face of the earth, some fish found it necessary to flap their way from one pool to another, and these eventually became

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amphibians. As they lived more and more on land, some of them became reptiles. Later on, some reptiles took to the trees in order to find prey and themselves avoid becoming prey to larger or swifter moving animals. The earliest apes evolved from these stem reptiles, and as the brain achieved ability to outwit brawn and speed, the apes again came down to earth, and some evolved into primitive man.

During these stages of evolution, the spearlike teeth of fish took on complex shapes, until the primitive mammals had evolved incisors, cuspids, premolars and molars set in sockets in internal jaws of bone. The jaws of primitive fish had originally consisted of many small bones, some of which grew to predominance, while others grew smaller and disappeared. The maxillae dwindled from twenty-two bones to two; the mandible, from eighteen bones to two, which joined at the symphysis early in life. Fish, amphibians and reptiles had no temporomandibular joints, the mandible being suspended by muscles; but the mammals had developed contact between the skull and mandible, in temporomandibular joints. It was the ability of the mammal to develop temporomandibular joints, complex tooth forms and complex jaw movements which enabled it to dominate the world, speed up its own metabolism and evolve to human status.

The general principle by which all this happened is simple, and it has been summarized by a paleontologist named Cope into what is known as Cope's law. Its basis is physiologic. Normal use stimulates cells to normal feeding, development and growth; subnormal use causes them to atrophy and become ill. Augmented use stimulates them to augmented ingestion, metabolism, growth and development. When life environment changed, and augmented use was made of some anatomic structure, countless succeeding generations developed the structure to perform the augmented function. Thus, evolution is not the survival of the fittest, but of the most adaptable.

Simple as this rule is, the manner in which augmented or different use could transform a tooth from styloid to triconodont form, consisting of three cones set in a row, and from that to tritubercular form, in which the three tubercles were staggered, will probably remain one of the profound mysteries of life and evolution. Nevertheless, the fact remains that from the primitive styloid dentition, four distinct masticatory types evolved, operating in four distinct mechanical manners, and all calling for coordination of anatomic parts to produce the mechanical function of chewing.

The carnivorous type is probably the least differentiated, consisting of temporomandibular joints which operate vertically in almost pure hinge motion, while the teeth are set in the jaws to operate vertically and have vertical cutting blades. These animals cut and tear off large chunks of meat and swallow them whole. Their first molars are designed for cutting tendons and their long cuspids suited for conflict or tearing.

The herbivorous type of dentition consists of temporomandibular joints designed for a wide range of lateral movements; the hinge factor is rudimentary. The grinding teeth are flat and broad, with several cutting blades extending anteroposteriorly and designed to cut during lateral movements of the jaw.

The rodent type has temporomandibular joints designed for anteroposterior movements, and the flat molars have several cutting blades extending buccolingually across the teeth, designed to cut during anteroposterior jaw movements. Each of these types is highly specialized and is designed for a specific type of use on a specific type of food.

The omnivorous animal eats all types of food and his masticatory apparatus is designed for universal use. It combines salient features of all three of the other types of dentition. The omnivorous human

being takes his incising stroke from the rodents. The jaw moves into the protrusive relationship and closes upon the bolus with the incisor teeth edge to edge. From the point of contact between tooth blades, the jaw moves posteriorly to centric relationship, shearing off a piece of the food mass as it goes.

The human being takes from the carnivora the crushing stroke, for piercing and crushing the bolus of food. He may perform several crushing strokes, with the bolus of food placed on one side of the dentures and the jaw closing in that lateral relationship or "terminal lateral position." There is a crushing stroke at the beginning of each shearing stroke.

The shearing stroke, appropriated from the herbivora, begins at the end of crushing closure in the lateral position corresponding to the side upon which the bolus is placed. Thus, if the bolus is on the right side of the mouth, the jaw closes in right lateral position. This closure represents the crushing stroke until opposing tooth cusps have contacted through the bolus. Then the jaw starts swinging toward centric relationship, dragging the mandibular denture across the maxillary one, so that many pairs of upper and lower cusps form pairs of shears for cutting food. The jaw normally swings through centric relationship and over to the opposite lateral position, where it swings open and returns to the point of beginning for another crushing and shearing stroke.

CUSP ACTION

Cutting by teeth is always passive. The teeth do nothing in themselves. The old legend that a tooth moves in function is truly a legend as far as function is concerned. Tooth movement in the socket is practically nil if the periodontium is healthy. It is purely the byproduct of the cushioning action of the periodontal membrane in breaking the shock of jaw closure, upon the supporting tissues. The tooth which moves perceptibly has an unhealthy periodontium and its functional ability is lessened by its movement, just as the effectiveness of a knife would be lessened if the blade were set in a velum rubber handle.

When the mandibular denture moves across the maxillary one, the dentures become a multibladed shearing machine, and it is logical that dentists should view it, not as a promiscuous assembly of teeth whose form and dimensions have no special meaning, but rather as a mechanism whose units have developed through countless eons of evolution to a form and dimension enabling them to cooperate harmoniously to perform the complex and yet simple function of mastication.

Tooth cusps cut in the two ways typical of all cutting. Cutting is always done by a moving contact point. One cutting point may be on a blade, ridge or convex surface, which gives it prominence. Two flat surfaces will not cut. One raised point will cut against a surface, however, as witness the Indian cutting a skin by laying it on a flat rock and forcefully dragging a rounded stone across it. The point at the peak of the convexity of the round stone pierces the skin and then moves across the flat surface below. The modern leather cutter uses a sharp knife upon a flat table. A point in the knife pierces the skin and cuts it by moving across the table.

Two ridges crossing each other will also cut effectively, because a point on the crest of one ridge pierces the material to be cut by pressing against a point on the crest of the opposing ridge. As the ridges cross each other, the contact point between them moves through the mass and cuts it. This is the manner in which rounded cusp ridges shear the bolus. Cusp ridges worn or synthesized to flat form cannot cut effectively. The denture, whether natural or artificial, is dull and to do its cutting requires an excessive force which will be injurious to the supporting tissues.

DERANGEMENTS OF MASTICATORY FUNCTION

Evolution, or heredity, has planned through the ages to deliver to each of us moderns a masticating assembly capable of multiple cusp contacts in all positions within the chewing range of the mandible. All three units of that assembly, the joints, the positions of teeth in the jaws and the structure and dimensions of the teeth themselves, give evidence that they were built to cooperate in function. The difference in angulation between the buccal and the lingual cusps of upper molars proclaims that buccal cusps are designed to operate in one angle jaw movement and the lingual cusps in another; and that is precisely what happens. The buccal cusps of upper right molars, for instance, operate in the shearing stroke from the initial right lateral position to and through centric relationship, with the mandible pivoting on its right condyle. Then, as the mandible swings its denture beyond centric relation to the left lateral terminal position, the jaw pivots upon its left condyle; the angle or arc of jaw and cusp movement changes, and the ridge of the lingual cusps of the upper molars become effective by shearing against the distobuccal or fifth cusp of the lower molar with which it cooperates. The very existence of the off-angled mesiolingual cusp of upper molars and the fifth or distobuccal cusp of lower molars proclaims that bilaterally balanced occlusion is man's heritage from evolution. Given such an occlusion, his masticatory ability is great; his digestive and metabolic processes will be optimal, and his general health and that of the periodontium will be maximal. Furthermore, the onerous burden of jaw force, which Robert Borland estimates at 45 pounds per square inch, as compared to only 3 pounds per square inch supported by the feet of an adult of average weight, is distributed throughout the entire denture instead of being exerted upon a very few teeth.

The fact that a large percentage of modern human beings do not have complete bilateral balance is no evidence that mankind is not intended to have it. A still larger percentage have *some* balancing contacts, ranging all the way from one pair of balancing cusps on the inactive side of the dentures to a complete set of them. Heredity is only one factor in the production of each human being's masticating mechanism. The other is environment, which often nullifies heredity. Both deficient prenatal diet and faulty intake of nutritional factors and vitamin activators during childhood's period of rapid growth militate against the perfect delivery of our heritage from evolution. Various abnormal pressures may warp the growing structures to malformation. Mouth-breathing and thumb-sucking are classic examples; but, as Atkinson and others have shown and every day observation will confirm, sleeping on the face and leaning on the jaw constantly during childhood will derange jaw growth and cause teeth to erupt in malposition and deranged function. Particularly common is the excessive vertical overbite of anterior teeth, causing them to hold the rest of the dentures apart during lateral and protrusive movements of the mandible, greatly reducing masticatory ability and throwing an excessive force upon the antagonistic teeth.

Derangements of the masticatory mechanism fall into three classifications: 1. There may be interference in lateral and protrusive functional movements of the jaw and denture. 2. Patients with malocclusion frequently perform the masticatory function in an eccentric jaw relationship, which I have termed a convenience relationship. During mastication, the condyle heads in the joints operate upon inclined surfaces, and the abnormal and excessive force application eventually induces a change in form under Cope's law. In non-masticatory closures, as in swallowing constantly (twice a minute during waking hours and once

a minute in sleep), the joints tend to close in their normal centric relationship, the condyles nesting in the bowls at the bottoms of the mandibular fossae. The teeth are then closing upon inclined cusp planes rather than nested between two converging planes which maintain the vertical direction of the force applied. Consequently, the teeth are subject to lateral thrust in abnormal directions and amount, and the periodontium will change, by breaking down, much more rapidly than the joints can change to accommodate the convenience denture and jaw relationship.

It is exceedingly important that the eccentric or convenience relationship be detected in making a diagnosis of oral conditions. Orthodontic treatment may aline teeth without cognizance of it. Indeed, the condition not infrequently develops during orthodontic treatment. At some point in the treatment, one tooth may interfere with true centric closure and mastication. The patient unconsciously moves his jaw to an eccentric relationship to avoid the interference. At his next visit, he "closes" for the orthodontist in the eccentric relationship, and from that point on the teeth are set up to that wrong jaw and denture relationship. Again, intermaxillary elastics may encourage the condyle heads to function forward of their normal relationship. The case is alined in that protrusive position. After the elastics are discarded, the joints gradually assume their normal relationship, and the case either remains in an undetected convenience relationship, or is considered to have relapsed, when really it was never fully corrected.

3. Another condition interfering with mastication and imperiling the periodontium I have termed centric interference. The dentures do not close squarely and evenly in centric relation, but strike first upon the inclined planes of cusp ridges and then slide to centric position. This bump and slide, in each centric closure, constitutes an abnormal anteroposterior thrust upon the teeth. Anteroposterior thrust is particularly deadly to the supporting bone. Lateral thrust is supported by the buccal and lingual cortical plates of the jaw, while anteroposterior thrust falls upon the cancellous bone between the cortical plates, and causes deep vertical interproximal resorption.

PATHOLOGIC OCCLUSION

There are limitations to the operation of Cope's Law. Evolution can convert apes into men and men back into apes. But who would expect, by taking to the trees, to evolve or devolve into an ape during one lifetime?

Thus, augmented function, exerting augmented force upon the periodontium, if kept within reasonable bounds, might develop in the periodontium in the course of thousands of years a ruggedness able to support the function. It cannot be done, however, in one generation.

Augmented function increases circulation to the parts, and increases cell metabolism and growth or proliferation of cells. If, however, the overstimulation is too long continued, circulation may be decreased by overproliferation of cellular and fibrous elements. Again, the tissue may become fatigued, and prolonged fatigue means that anabolism cannot keep up with katabolism. The tissue breaks down.

Analysis of masticatory function demonstrates several things which may be set down as the laws governing the physiology of mastication:

1. While the so-called balancing contacts of cusps and teeth do balance the dentures and the jaw by contacting upon the inactive side of the mouth, they perform a far more important function on the active side, upon which the bolus is being chewed: they are active shearing contacts on the working side of the jaw.

2. When such contacts are present, in so-called balanced occlusion, the jaw functions by swinging through centric relationship and on over to the opposite

terminal lateral position. This normal swing of the jaw utilizes the entire occlusal surface of upper molars.

3. Cuspal antagonism, and particularly the interference of excessively long anterior teeth and cuspids, unbalances the occlusion so that there is no contact between the upper lingual cusps and the lower buccal cusps. The entire rhythm of jaw movement then changes. The jaw swings to centric relationship only, and then swings open to commence another crushing and shearing stroke.

4. With increased cuspal interference, the jaw swing or stroke becomes more vertical and shorter. In extreme cases, it becomes merely a chop stroke. When closed in centric relationship, this condition constitutes the so-called "locked bite." Lateral and protrusive movement is then impossible and the jaw must open directly downward.

5. The menace of occlusal derangement to the periodontium increases in direct proportion to the severity of the derangement. Each masticatory closure in a chop bite jars the periodontium; whereas the smooth rhythmic verticolateral swing of the jaw in normally balanced occlusion exerts minimum force and shock upon the supporting tissues.

6. Occlusal derangement may be considered pathologic occlusion because, while free of pathosis at the inception, the prolonged abnormal function it induces results in pathosis of the functioning structures. The teeth wear and/or the periodontium breaks down. If the teeth wear freely, periodontal pathosis will be less. If the teeth resist wear, the periodontium suffers more.

7. For the prevention of periodontal pathosis and the fullest development of masticatory function, which is a vital prerequisite of normal metabolism and bodily health, occlusal derangement should be a major consideration in all phases of dental practice. All oral treatment should be based upon true centric denture and jaw relationship, and the occlusion should be bilaterally balanced. This anatomic and physiologic perfection should be achieved in childhood by orthodontic treatment the aim of which is function first and appearance second. Failing that, it should be achieved in early adult life by selective grinding, scientifically done, and restorations. In later adult life, "occlusal reconstruction" by inlays, veneers, bridges and partial dentures, a most complex, time-consuming and costly operation, becomes necessary. Ultimately, it is accomplished by full dentures.

Every conscientious dentist should be constantly mindful that he is studying and treating a mechanism which is constantly in motion. Its motions should be studied and made the basis of all procedures in clinical practice. All treatment should be based upon gnathodynamics rather than gnathostatics.

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STIFFNESS CHARACTERISTICS AND BENDING TESTS AS APPLIED TO DENTAL MATERIALS

By JOHN S. SHELL,* Chicago, Ill.

THE question of adequate testing methods for determining the usefulness of dental materials has presented some unusual problems to the engineers, metallurgists, chemists and physicists in this field of investigation. The small dimensions in dental restorations and the costliness of many of the dental products when compared with those of the usual engineering structures have created the necessity for special testing machines of a capacity to give the most useful information. Baby Brinell tests have been accepted as the standard in place of standard Brinell data, primarily because of the necessity for testing thin sections, and the specimen size for castings has been reduced from the standard size almost to dental dimensions for use in the tension test.

The interpretation of these data in semitechnical terms in a manner to be most useful and intelligible to the dental profession has been one of the major ancillary problems of the research worker on dental materials. Unfortunately, this problem has not always been so successfully solved as might be desired, primarily because of the very complicated design of many dental restorations, and, secondarily, because the dental operator is hesitant to accept data which have been obtained in a manner so far removed from the usual technical procedures.

Bending and stiffness tests are not offered as a substitute for the recognized standard tests, although they offer unusual advantages for demonstrating certain characteristics of dental materials. Bending tests which consist of alternate bending through 90 or 180 degrees are discussed in the literature dealing with testing materials and have been investigated and reported for some dental materials. These tests offer the advantage of a ready appreciation of their value by the dental operator, but suffer from the disadvantages of uncertainty regarding the method of testing and the interpretation of the results in the terms of engineering metallurgy. Bending tests are the first tests applied by most dental technicians when attempting to determine the relative merits of clasp wires or orthodontic band materials. Manual bending tests are made to estimate two qualities of the material in which the dental operator is interested: 1. The ability of the metal to bend definitely without fracture, which is important in the adjustment and fabrication of the restoration. 2. The stiffness characteristics* of the metal after fabrication, which are important in the function of the restoration in the mouth. The Tinius Olsen Stiffness Tester (Fig. 1) provides data of this nature

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*Director of research and development, Thomas J. Dee & Co.

*The term "stiffness characteristics" is used in this paper to indicate the resistance to bending of the test specimen over the entire range of the test from 0 to 90 degrees. This corresponds rather closely to a technician's conception of stiffness. He is interested in how easily a wire can be manipulated, how strongly it resists permanent bending and how far it can be bent before it is permanently deformed.

through direct bending tests, with one important qualification. The test consists of a single 90 degree bend; but, in addition to giving data relative to the stiffness and bending ability up to the limit of one right angle, it provides some very desirable information regarding the properties and usefulness of dental materials.

Reports on bending tests as applied to dental metals have been made by a number of investigators. Coleman[1] reports some tests made on a Francke machine. Irish,[2] Aderer[3] and Moore and Peyton[4] have reported tests on instruments of their own design. Brumfield[5] and Nowak[6] have presented information on structural fea-

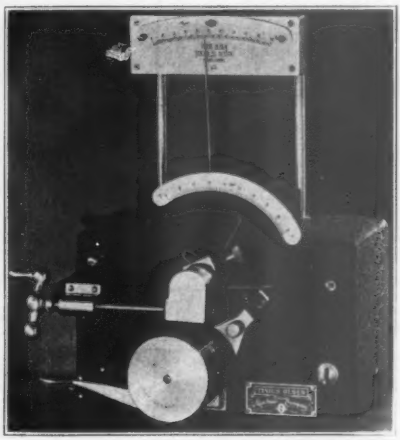


Fig. 1.—Tinius Olsen stiffness tester.

tures, and I[7] have reported on the stiffness tester as a control instrument for standardizing heat-treating technics. A considerable number of data on reversal bending tests have been collected by many manufacturers and some of these have been published.[8] This discussion cannot include a consideration of alternate flexure bending tests designed to determine the fatigue value of dental materials.

The following advantages of the stiffness tester method and a description of its operation are taken from a paper by MacBride,[9] with a few alterations necessitated by the design of the tester under discussion:

1. Specimens are easily prepared. Wires, ribbons and narrow strips, ordinarily received in coils, are tested without straightening and thus introducing variable amounts of cold work. Sheets are merely sheared roughly to shape and then notched.

2. The test is consistent in that tests on like samples can be depended upon to repeat within 1 per cent of the load reading.

3. The test is sensitive in detecting small variations in elastic and plastic qualities.

4. In many cases, the straining action of the test closely approximates the demands upon the material in service.

5. The test is quickly and easily made and requires little skill on the part of the operator.

This machine operates on the cantilever-bend principle. A specimen is shown (Fig. 1) clamped in the vise, which is turned about a central spindle, either by hand, using the crank shown at the left, or by motor through gearing. The lever for engaging and disengaging the motor is just below the hand crank. Cantilever bending of the specimen is obtained by rotating the vise in a clockwise direction, pressing the free end of the specimen against the upper side of the rest, shown projecting from the dial face. This dial is part of the pendulum which is free to swing on ball bearings concentric with the rotating vise. Different capacity ranges are obtained by placing different weights on the pendulum pin. Engraved on the lower scale is the angular deflection scale, reading from 0 to 90 degrees. The deflection pointer moves with the vise, to which it is secured by a friction or slip collar, so that adjustment to zero can be made at the start of the test in the event that the specimen is not exactly straight. The deflection reading, in degrees, is the angle included between the original position of the roller bending pin, the edge of the vise, which is on the center of rotation, and the position of the bending pin after load is applied and the specimen bent. Load is indicated on the upper scale, fixed to the housing, the graduations on this scale being from zero, when the pendulum is at rest, to 100 per cent, when the pendulum has been lifted through 30 degrees by the reaction of the specimen.

With the 5-inch pound machine, specially designed to carry 7-inch pound weights, gold alloy specimens up to 0.0625 inches in diameter can be tested, with the 2 inch span. Weights down to 0.1 inch pound are available and spans down to one-fourth inch.

If the data obtained from the stiffness tester are plotted with the angle of bend as abscissae and the load required to cause the bend as ordinates, a curve is obtained which resembles the tensile stress-strain diagram. This diagram is the simplest means for reporting the data obtained with this machine. The angle which the straight portion of the curve makes with the horizontal gives an indication of the modulus of elasticity, and the break in the straight line corresponds to a yield point or proportional limit. No simple accurate calculation of the modulus of elasticity as determined in tension from this angle has been developed. In testing certain types of metals, there is an indication of a lowering of the bending load corresponding to the yield point.

The specimen may not fracture when bent to 90 degrees, and, in this case, the spring back after a 90-degree bend gives an additional indication of the "elasticity" of the material (point "B" in the graphs). The ability of a metal to spring back after bending to 90 degrees apparently is related to the "proportional limit" as indicated by the stiffness tester, and MacBride[9] presents data that indicate some correlation between the set angle and the elongation. This value is of importance in selecting materials for orthodontic use and also for clasp metal, in

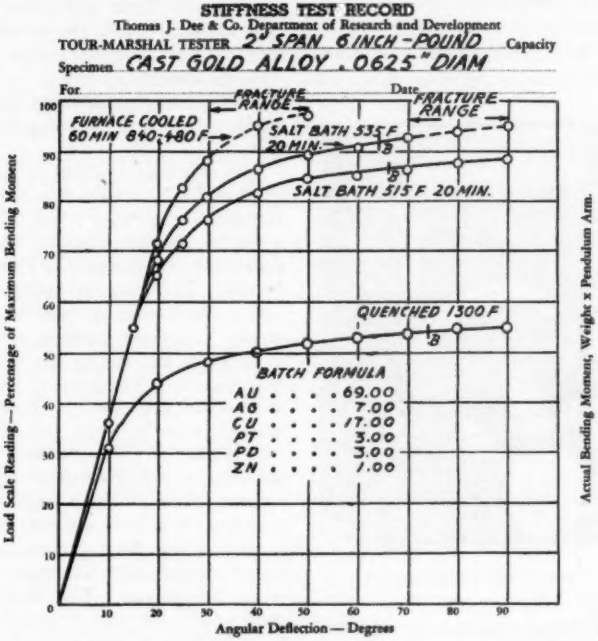


Fig. 2.—Data obtained on stiffness tester with gold colored casting gold. (The formulae given in Figures 2-4, to the best of the author's knowledge, do not represent those used by any manufacturer. They were chosen to illustrate the method of testing and are not recommended for any particular type of dental restoration.)

either the wrought or the cast condition.

The rate of increase in bending load per degree bend usually approaches a straight line before a 90-degree bend is reached. The form which this line assumes probably indicates the rate of strain hardening resulting from cold work and may be of some value in measuring this property in alloys employed for swaging dentures. MacBride[9] believes that the area under the curve is proportional to the toughness of the sheet metal. This area could be considered a measure of toughness in comparing specimens which break before the 90-degree bend occurs, or which closely approximate the breaking point at 90 degrees.

Among the many types of data which may be obtained with the stiffness tester, those which indicate the changes in mechanical properties brought about by the heat treatment of dental gold alloys are unusually illuminating. By using the same bending load, bending span and size of specimen and varying the heat treatment, the effects on the stiffness characteristics and bending ability can be determined rapidly and accurately. When cast samples are to be tested, a number of bars can be cast in the same mold. After cast bars, wires or band materials are subjected to various types of heat treatment, the variation in stiffness and bending characteristics, both below and above the proportional limit, can be determined. With the stiffness tester as a control instrument, it has been possible to develop a heat-treating technic for cast clasp alloys which provides the dentist or his technician with a final product whose stiffness characteristics are adequate, allowing enough capacity for elastic bending to permit insertion and removal from the mouth. A less drastic heat treatment is

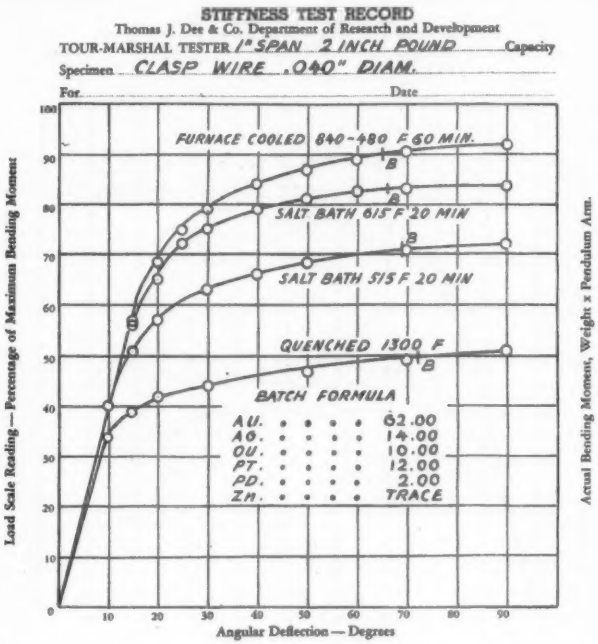
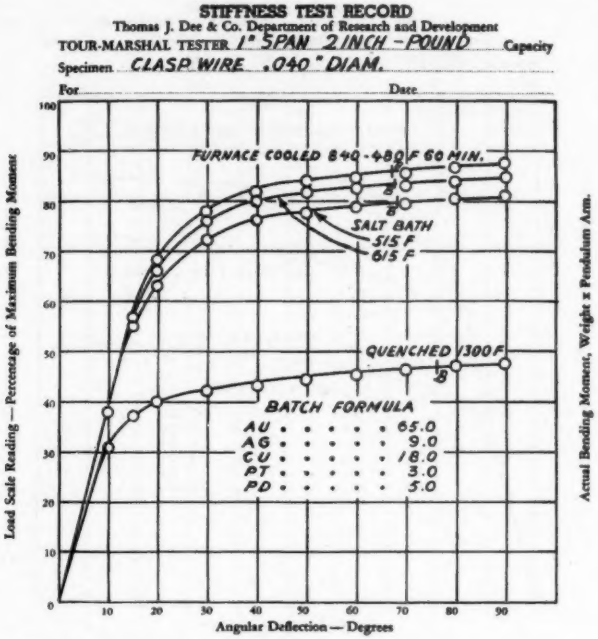

STIFFNESS TEST RECORD
Thomas J. Dee & Co. Department of Research and Development
TOUR-MARSHAL TESTER 1" SPAN 2 INCH POUND Capacity
Specimen CLASP WIRE .040" DIAM.
For Date
FURNACE COOLED 840-480 F 60 MIN.
SALT BATH 615 F 20 MIN
SALT BATH 515 F 20 MIN
QUENCHED 1300 F
BATCH FORMULA
AU. 62.00
AG. 14.00
CU. 10.00
PT. 12.00
PD. 2.00
ZN. TRACE
Load Scale Reading — Percentage of Maximum Bending Moment
Actual Bending Moment, Weight x Pendulum Arm.
Angular Deflection — Degrees

Fig. 3.— ta obtained on stiffness tester with platinum colored wire.

necessary when slight adjustments must be made after the original heat treatment. This procedure is never recommended, but, under certain circumstances, it may be necessary, and in the development of a heat treating technic for use by the dentist or technician, this fact must be considered. When a constant temperature heat treatment is used for a definite period of time, it is possible to provide considerable toughness without a significant decrease in "yield point or proportional limit" from the maximum which it is possible to obtain by the most drastic heat treatment.


STIFFNESS TEST RECORD
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TOUR-MARSHAL TESTER 1" SPAN 2 INCH - POUND Capacity
Specimen CLASP WIRE .040" DIAM.
For Date
FURNACE COOLED 840-480 F 60 MIN.
SALT BATH
515 F
615 F
QUENCHED 1300 F
BATCH FORMULA
AU 65.0
AG 9.0
CU 18.0
PT 3.0
PD 5.0
Load Scale Reading — Percentage of Maximum Bending Moment
Actual Bending Moment, Weight x Pendulum Arm.
Angular Deflection — Degrees

Fig. 4.—Data obtained on stiffness tester with gold colored wire.

Figure 2 shows a typical chart of the data obtained with the stiffness tester, using a cast alloy. Cast bars 0.0625 inches in diameter are used with a 6-inch pound weight and a span of 2 inches. Each curve is obtained by averaging the values determined on three or more bars, using two or more different castings. The bending load at 90 degrees for duplicate specimens seldom differs by more than 3 per cent. The lower curve indicates the stiffness in the quenched condition and the three upper curves in three different heat-treated conditions.

Furnace cooling for sixty minutes gives the greatest "yield point," but the brittleness is increased to such an extent that the specimens fracture between 30 and 50 degree bends. Substituting a salt bath treatment for twenty minutes at 535 F. (280 C.) decreases the brittleness to such an extent that all specimens can be bent to 70 degrees and many of them to 90 degrees, without fracture. Changing the temperature of the salt bath to 515 F. (268 C.) and retaining the time of treatment at twenty minutes decreases the "yield point" only slightly and decreases the brittleness to such an extent that all

specimens can be bent to a full 90 degrees without fracture. The increased bending capacity obtained by the constant temperature treatment more than compensates for the slight decrease in "yield point" in the three heat-treated conditions. The ultimate tensile strength and elongation corresponding to the stiffness characteristics are given in Table 1.

TABLE 1.—ULTIMATE TENSILE STRENGTH AND ELONGATION (CAST ALLOY)

	Ultimate Tensile Strength Pounds Per Sq. Inch	Elongation Per Cent
Quenched Salt bath 515 F. (268 C.) 20 minutes	110,000	4
Salt bath 535 F. (280 C.) 20 minutes	113,000	3
Furnace cooled 60 minutes 840 to 480 F. (450 to 250 C.)	120,000	1

TABLE 2.—ULTIMATE TENSILE STRENGTH AND ELONGATION (PLATINUM COLORED WIRE)

	Ultimate Tensile Strength Pounds Per Sq. Inch	Elongation Per Cent
Quenched Salt bath 515 F. (268 C.) 20 minutes	125,000	15
Salt bath 615 F. (324 C.) 20 minutes	140,000	10
Furnace cooled 60 minutes 840 to 480 F. (450 to 250 C.)	150,000	2

In Figure 3, the effect of heat treatment on a platinum colored wire is indicated. The specimens were 0.040 inch round wires using a 2-inch pound weight and 1-inch span. Each curve is obtained by averaging the values obtained from six specimens. The bending load at 90 degrees seldom varies more than 2 per cent for specimens treated in the same manner. The lowest curve represents the stiffness in the quenched condition. A second curve indicates the stiffness obtained by placing the annealed wire in a salt bath for twenty minutes at 515 F. (268 C.). The third curve shows the increase in stiffness obtained by increasing the salt bath temperature to 615 F. (324 C.), and the upper curve shows the stiffness effected by furnace cooling from 840 to 480 F. (450-250 C.) in sixty minutes. This figure indicates the need of different heat treatments for platinum colored wire and cast gold colored alloys. Some of the gold colored wires heat treat satisfactorily at the low temperatures required for the casting metal, but do not approach brittleness at the higher heat treating temperatures. The ultimate tensile strength and elongation corresponding to the stiffness characteristics are given in Table 2.

TABLE 3.—ULTIMATE TENSILE STRENGTH AND ELONGATION (GOLD COLORED WIRE)

	Ultimate Tensile Strength Pounds Per Sq. Inch	Elongation Per Cent
Quenched Salt bath 515 F. (268 C.) 20 minutes	75,000	20
Salt bath 615 F. (324 C.) 20 minutes	108,000	3.5
Furnace cooled 60 minutes 840 to 480 F. (450 to 250 C.)	115,000	3
	128,000	2

Figure 4 shows the stiffness characteristics of a gold colored wire in the quenched and heat treated states. The same size wire and testing characteristics were used as in Figure 3. The lower curve again represents the results obtained in the quenched state and the three upper curves are the results obtained after heat treating by three different methods. The difference between these three curves is so slight as to be of no practical importance.

Gold colored wire of this type is heat treated almost as readily at 515 F. (268 C.) as at 615 F. (324 C.), and furnace cooling from 840 to 480 F. (450 to 250 C.) in sixty minutes makes little change in the stiffness and bending characteristics. The ultimate tensile strength and elongation corresponding to the stiffness characteristics are given in Table 3.

There is no justification for the blanket assumption that higher values for all physical properties indicate better materials. It may be advisable to use a member of such a shape or size in a dental restoration that the low modulus of elasticity contributes a great deal more to the success of the case than would a high proportional limit, ultimate tensile strength or stiffness. The selection of a material merely because it has high values for certain physical properties is never merited without consideration of the cross-sectional dimensions, the type or design of the restoration, the characteristics of the patient, the possibility of discoloration during manipulation or subsequent use in the mouth and a host of other important facts. The dentist is the only authority on many of these considerations, and the ultimate choice of a material should depend on his ability to select the best, based on an adequate scientific knowledge of each contributing factor.

Stiffness tests on resins used for partial dentures indicate a maximum bending load at about a 50-degree bend, after which the load decreases. This corresponds to the decrease in tension after the ultimate tensile strength, as exhibited by many materials when tested in tension, is reached. Recovery after deformation can be clearly shown by the variation in the set angle. Schoonover and Sweeney[10] have reported data on cross-bend properties of denture base material, using an instrument of their own design.

Tests on dental amalgams have not proved very satisfactory. Although such tests give an indication of brittleness, it may be possible to develop some type of flow test for amalgams, using the stiffness tester. Dental waxes and impression compounds have also been tested, and different products show considerable variation in stiffness characteristics.

SUMMARY

1. The Tinius Olsen Stiffness Tester provides a simple and effective means of testing the bending and stiffness characteristics of many dental materials.

2. This machine is especially valuable in determining the extent to which heat treatment of precious metal alloys can be carried without inducing dangerous brittleness.

BIBLIOGRAPHY

1. Coleman, R. L.: Physical Properties of Dental Materials. Research paper No. 32, Bureau of Standards, December 1928.

2. Irish R. E.: Conscious Constructive Application of Pressure. *Internat. J. Orthodontia,* 13:528, June 1927.

3. Aderer, Julius: Elasticity of Piano Wire Compared with Elasticity of Certain Platinum Gold Wires. *The Aiderer,* 6:4, February 1928.

4. Moore, G. R., and Peyton, F. A.: Measuring Forces of Displacement in Orthodontic Spring Appliances. *Internat. J. Orthodontia,* 19:683, July 1933.

5. Brumfield, R. C.: Structural Features Related to Orthodontic Materials and Appliances. *Internat. J. Orthodontia,* 16:1050, October 1930; 17:5, January 1931.

6. Nowak, L.: Die Mechanishe Krafte der Fingenfederchen. *Fortschr. d. orthodontic,* 1: 69, 1931.

7. Shell, J. S.: Advantages in Use of Safe Heat Treating Technic for Gold Alloys. *D. Craftsman,* 12:9, March 1938. Hodgen-Shell Dental Materials. St. Louis: C. V. Mosby Company, pp. 160-162.

8. Brumfield, R. C.: Jelenko Gold Bulletin No. 1, December 1939, p. 18.

9. MacBride, H. L.: Stiffness or Flexure Test. American Society for Testing Materials. Reprint, 1937.

10. Schoonover, I. C., and Sweeney, W. T.: Some Properties of Two Types of Resins Used for Dentures. J.A.D.A., 25:1487, September 1938.

MIGRATION OF LEUKOCYTES INTO THE DENTINAL TUBULES

By BALINT ORBAN, M.D., D.D.S., Chicago, Ill.

THAT the polymorphonuclear leukocytes play an important part in the defense mechanism of the body during inflammatory reaction is well known. These cells migrate from the blood vessels, probably owing to a chemotactic condition, into the surrounding tissues. In the tissue, they engulf foreign substances, bacteria or dead cell particles, and probably liberate some kind of antitoxin or enzyme in their disintegration. It is also well known that there are three types of leukocytes in the blood stream: the neutrophile, basophile and eosinophile granulated leukocytes. The largest number, from 60 to 70 per cent, of these are the neutrophils, while the basophils are only from 0.5 to 1 per cent and the acidophils or eosinophils, 1 to 3 per cent.

In the inflammatory reaction, it is asserted, the neutrophile granulated leukocytes are the active elements. The function of the basophile and eosinophile elements is uncertain. Sometimes, the eosinophile cells appear in great numbers in the tissues, but their significance has not yet been explained. It is claimed that they have phagocytic activity. It is known that the neutrophile granulated leukocytes make up the defense mechanism in acute inflammation. The eosinophile cells are most often found in chronic irritations.

The leukocytes are generally known as the white blood cells or corpuscles; but they are not the only cells making up that group. The nongranulated white blood cells—the lymphocytes (20 to 40 per cent) and the monocytes (2 to 6 per cent)—are also a part of this group. Maximow calls all these cells leukocytes, differentiating them by the fact that the cytoplasma of the first group is granulated, that of the second group being nongranulated. Their function also seems to distinguish them, as the granulated cells are present in acute inflammation, while the non-granulated cells act in chronic inflammatory reactions.

All these cell types can, of course, be recognized in the human dental pulp, which reacts to irritation as does any other connective tissue in the body; and the characteristics of the human pulp make it possible for these cells to fulfil their function. Injury to the teeth, sudden as well as of long duration, may cause changes which lead to inflammatory reactions. Bacterial toxic conditions arising from caries will always result in inflammation. Chemical irritation from food such as fruit acids, concentrated sugar, alcohol and tobacco may reach the dentinal tubuli, by a change in osmosis or surface tension which is transmitted to the pulp. Irritation might also result from extreme heat or cold, or from dental operations such as preparation of a cavity, generating heat with the bur or stone. Chemical irritation, in dental operations, is mostly produced by the use of drugs, such as phenol, alcohol, xylene, formaldehyde, eugenol and silver nitrate. Acid cements and silicates have the same action.

Any of these conditions may have an inflammatory reaction. Cases of tooth

From the Northwestern University Dental School.

Read before the Chicago Section of the International Association for Dental Research, October 27, 1939.

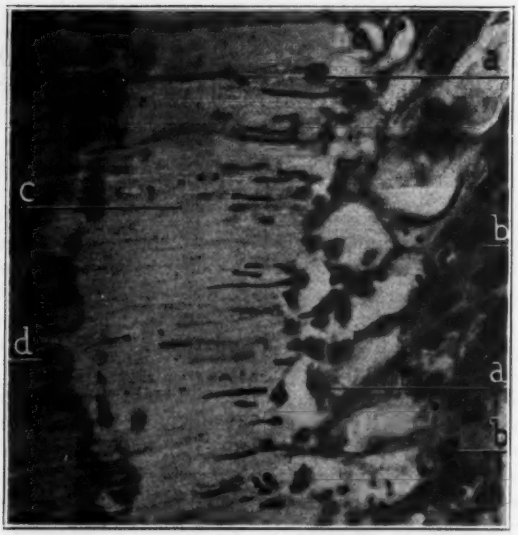

Fig. 1.—Acute inflammatory reaction in pulp. Leukocytes (a) migrated between the odontoblasts (b) and the dentin. Some of the leukocytes migrated into the dentinal tubules. c, uncalcified dentin. d, calcified dentin.

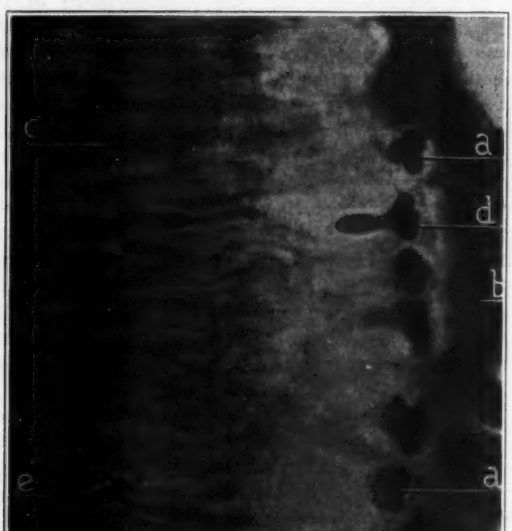

Fig. 2.—Leukocytes (a) between odontoblasts (b) and dentin (c). One leukocyte (d) is starting to migrate into a dentinal tubule. e, cell with eosinophile granules in its cytoplasma. This is an eosinophile leukocyte.

pain due to cold or heat and the presence of salty or sour food are often seen. This pain is relieved when the carious dentin is removed and the cavity filled. It is probable that, in the pulps of these teeth, we could, with the microscope, find signs of inflammatory reaction. It is also noted that after the cavity has been prepared and the filling placed, the tooth may be sensitive to thermal changes. It may also feel sensitive in biting, or even without any apparent cause. In a few days, the tooth will become quite comfortable. It is evident that there had been a reaction in the pulp. In thinking of an inflammatory reaction, we are inclined to picture an acute process, such as abscess formation. However, it is far from that stage. At the most, there may be a slight hyperemia, with slight edema, and migration of a few leukocytes from the capillaries, and this would disappear in a few days. The reaction will, of course, depend largely on the type and severity of the irritation and whether it caused definite, irreparable damage or had only a temporary effect.

In studying these conditions, I encountered a specimen which showed an activity of the leukocytes that I had not seen before. This was an incisor in the mouth of a man about 40 years of age. The tooth was extracted in making a dental restoration. The gum had receded and about 2 mm. of the cementum was exposed. Two weeks previous to the extraction, a cavity was prepared in the crown portion of the tooth on the labial side. The cavity was treated with ammoniacal silver nitrate solution and the

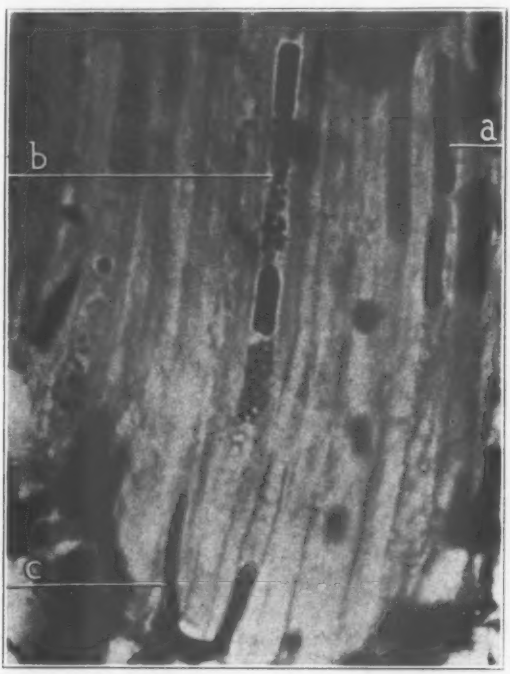

Fig. 3.—Neutrophile (a) and eosinophile leukocytes (b) in dentinal tubules. At the pulp, one cell extends into two tubules (c).

silver reduced with eugenol. The cavity was dried and filled with oxyphosphate cement. The extracted tooth was fixed in Zenker-formol solution (90 per cent Zenker and 10 per cent formaldehyde) freshly mixed. For proper fixation of the pulp, the hard tooth structures must be ground off as close as possible to the pulp tissue without exposing it. Only at the side of the cavity is the dentin left untouched. The grinding should be done with a fast cutting stone, preferably a diamond stone, under a continuous stream of water. Only a thin block of the tooth remains, covering the pulp. Of course, grinding must be done immediately after the extraction of the tooth. Fixation should not take longer under these conditions than about eight hours, or overnight.

After fixation, the specimen is washed in running water for a day and decalcified in 5 per cent nitric acid. Decalcification will not take longer than from twenty-four to forty-eight hours if enough hard substance is removed by grinding. After decalcification, the specimen is taken through the dehydration process and is embedded in celloidin in the usual way. The main thing in studying the pulp is proper fixing and reducing the decalcification process. It is evident that, by removal of a large part of the cementum and dentin, the celloidin can more readily penetrate the pulp and the specimen can easily be cut. The specimens are cut 8 to 10 microns in thickness and can be stained in different ways as desired. I prefer hematoxylin—eosin, azure II—eosin for studying the cellular structures.

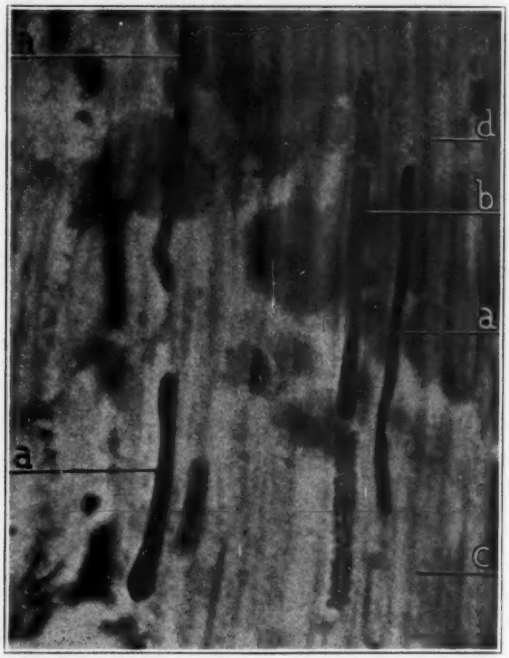

Fig. 4.—Neutrophile (a) and eosinophile (b) leukocytes in dentinal tubules. c, uncalcified dentin. d, calcified dentin.

Bacterial stains and silver impregnation often prove advantageous in studying pulp and dentin conditions.

The specimen mentioned above showed a slight acute inflammatory reaction just below the cavity. There were mostly leukocytes and a few non-granular wandering cells (lymphocytes) present.

The most peculiar condition could be observed at the inner surface of the dentin. The odontoblasts were separated from the dentin at several points, and, between the odontoblasts and the dentin, a large number of leukocytes were present.

The dentin also presented a peculiar picture. In the tubuli, the cytoplasma had a granular appearance, and, in some tubuli, dark bodies could be seen. (Fig. 1.) These dark bodies are elongated. They fill out the tubules and are found mostly in the uncalcified part of the dentin, but they can also be seen entirely in the calcified dentin. A study of the whole series of sections under high power revealed that these dark bodies are largely leukocytes, which probably migrated from the pulp into the dentinal tubuli. In evidence, the accompanying microphotographs are presented.

In Figure 2, the borderline between the pulp and the dentin is seen. The odontoblasts are flattened and are separated from the dentin by foreign cells, which

Fig. 5.—Eosinophile leukocyte (a) in calcified dentin. Most of the eosinophile granules are toward the pulp of the nucleus; while, toward the periphery, there are but few. b, calcified dentin. c, uncalcified dentin.

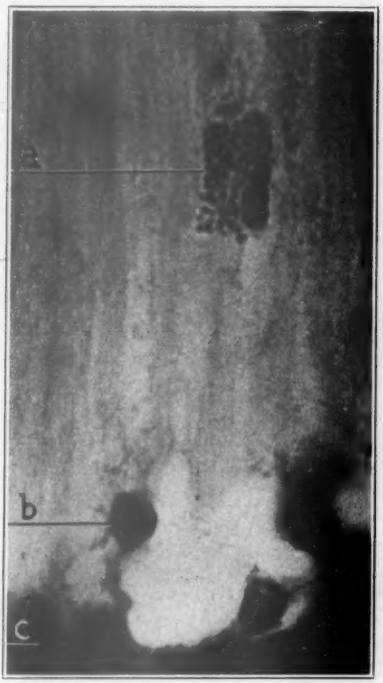

Fig. 6.—Eosinophile leukocyte (a) in dentin, most probably located at confluence of two or more dentinal tubules. b, leukocyte at entrance to dentinal tubule. c, odontoblasts.

can easily be recognized as leukocytes. They show a nucleus of three or four lobules. One of these cells extends into a dentinal tubule. Higher up in the dentin, other dark bodies can be seen. Special attention should be paid to the one in the lower left corner of the picture. Not only does this body show the dark elongated segmented nucleus, but also some granules are lying in the dentinal tubules. These granules stain a bright red, indicating their eosinophile character. According to all the evidence, this is an eosinophil. The eosinophils are especially numerous in this pulp and have, therefore, helped greatly in the identification of the cells in the dentinal tubuli as leukocytes.

Fig. 7.—Two leukocytes (a) in wider space in dentin. This space is probably created through the union of two or more dentinal tubules. b, uncalcified dentin. c, calcium globules. d, calcified dentin.

Several other specimens show these cells in the dentinal tubules. In Figure 3, there is an eosinophil at the borderline of the calcified and uncalcified dentin. Two separate nuclei are seen, and in between the nuclei are eosinophile granules. Similar granules are also seen toward the calcified dentin in advance of the nucleus and behind the nucleus toward the pulp. In the hematoxylin-eosin specimens, these granules are red, while the nucleus is dark blue. The magnification of this picture is nearly 3,000. All other pictures shown in this paper are magnified between 1,000 and 3,200 times.

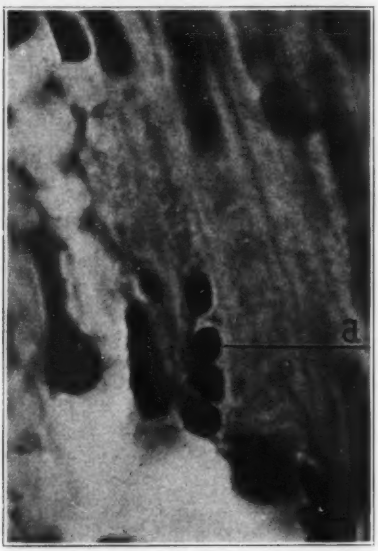

Fig. 8.—Leukocyte (a) with four lobules of nucleus starting to migrate into dentinal tubule.

In Figure 3, the granulated appearance of the content of the dentinal tubuli is evident. At the right of the picture, two dark bodies in one tubule also indicate the presence of a leukocyte, most probably a neutrophil, because the granules of the cytoplasma are much finer and not so definite as those in the eosino-

phil. A cell is also seen extending into two dentinal tubules at the pulp; which is not uncommon in these specimens.

Figure 4 shows another section with several bodies in the dentinal tubuli, one of these an eosinophil. The nucleus is in the center of the cell, while the granular cytoplasma is on both sides of the nucleus. The other bodies seen in the dentin are probably of the neutrophile type of leukocyte. The eosinophil is found here, partly in the calcified and partly in the uncalcified dentin. The calcium globuli clearly show this borderline. The length of this eosinophil is 40 microns. The width of the dentinal tubuli in this region is from 2 to 3 microns.

In Figure 5, an eosinophil is seen entirely in the calcified dentin. The granules are on both sides of the nucleus.

Figure 6 demonstrates an eosinophil of a different shape from those previously shown. It probably lies in two dentinal tubules, which may have opened into each other at this point, giving space for the cell in its present shape. In the pulp, we can see some of the odontoblasts and a neutrophil at the entrance to a dentinal tubule.

These pictures bring up the question as to how it is possible for a leukocyte to migrate into a dentinal tubule, which is much narrower than the leukocyte. The size of an eosinophil is about 10 microns, that of a neutrophil, about 8 microns; while the size of a dentinal tubule at the pulpal end might be from 2 to 4 microns. Almost every book on histology gives a different size for the dentinal tubuli. Bodecker (1926), 2 microns;

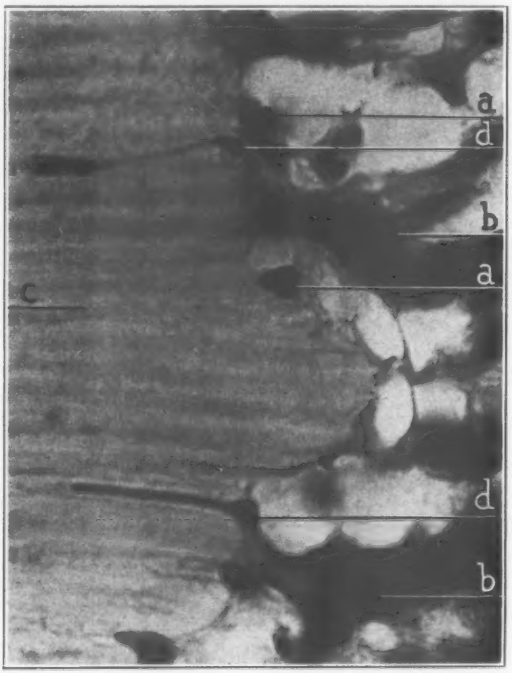

Fig. 9.—Leukocytes (a) between odontoblasts (b) and dentin (c). Two leukocytes (d) extend far into dentinal tubules.

Noyes (1929), 2 microns; Noyes, Schour, Noyes (1938), 3 to 4 microns at the pulp, 1 micron at the outer surface; Beust (1934) 2.5 microns; Kronfeld (1937), from 2 to 3 microns; Meyer (Churchill) (1935), from 3 to 4 microns; Meyer (1929) (Port-Euler), 2 microns; Schaffer (1933), from 4 to 6 microns. We know that the leukocyte can change its shape and migrate through the capillary walls and also through the intercellular spaces between the epithelial cells in the mucous membranes. The same process takes place in the dentin. The leukocytes change their shape, elongating and becoming much narrower, and squeeze themselves into the tubuli. If the tubuli are wider, the shape is less changed. (Fig. 7.) Two neutrophils migrated here into the same space, which probably was formed by the union of two or more tubuli. The lobulated nuclei are easily recognized here, and there is no question about their being leukocytes.

In Figure 8, the shape of a leukocyte with four lobules of the chromatin starts to change somewhat more, it appears, than that of the two cells in the previous picture changed. This cell just starts to migrate into a tubule. There are only gradual differences in deformation between these cells and the one in Figure 9, which shows the borderline between pulp and dentin. The odontoblasts are present, but, at different points, they are separated from the dentin. Leukocytes are seen here. In two spots, the leukocytes started to migrate into the dentin, extending far into the tubules, while a part of the body can be seen in the pulp. This is the pic-

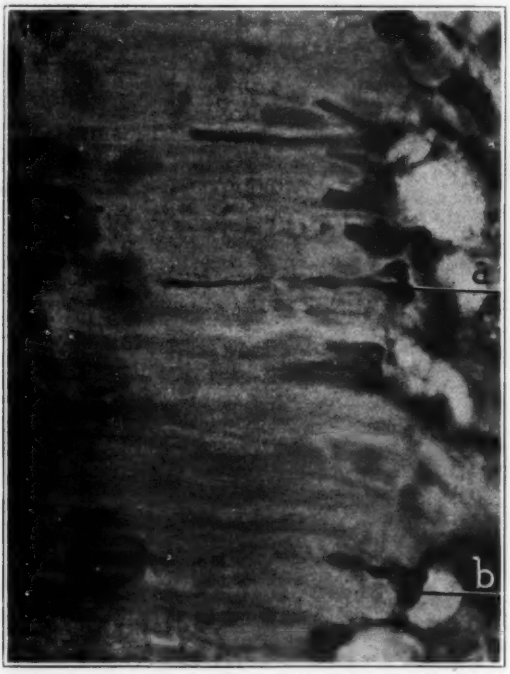

Fig. 10.—Leukocytes starting to migrate into dentinal tubules at several points. The cells at a and b show the segmented nuclei of typical leukocytes.

ture we often see of leukocytes migrating from blood vessels or through the mucous membrane of the mouth or gum. A similar picture is shown in Figure 10, but here the segmented, lobulated nucleus of the leukocytes can be seen more readily. Note especially the cell in the middle and lower end of the picture.

Sometimes the lobulated nucleus of a leukocyte is recognizable, even in the dentinal tubuli. (Fig. 11.) Several bodies are seen here, partly in the uncalcified and partly in the calcified area of the dentin. One of these shows a relatively straight unsegmented nucleus; another shows three different segments of the nucleus connected with one another by fine chromatin bridges. We can see this in the leukocytes of the blood stream or in the tissues. It is shown again in Figure 12. This segmented appearance indicates quite clearly the origin of the cell, even in the changed shape, dimensions and unusual location.

The question, of course, arises as to whether it might be possible that these cells did not actively migrate into the dentinal tubuli, but were trapped in the dentin, by dentin which formed quickly, owing to irritation. This, of course, might happen, and often does happen to odontoblasts in secondary dentin formation. However, in this particular case, it is not possible. First of all, if a cell is trapped in the dentin, we usually find the cell in its original, or a slightly distorted, shape. There would be no reason for the cell to assume the long, stretched-out outline. Also, we can find behind the leukocyte, toward the pulp, a dentinal tubule, which

Fig. 11.—Leukocytes in dentinal tubules. The cells at a and b show a relatively uniform nucleus; while the one at c shows a segmented nucleus with three lobules connected by fine threads.

could not be formed without the odontoblast. Odontoblast process and leukocyte could hardly find a place side by side in the same tubule. There is also another finding which contradicts this supposition, and that is that leukocytes are migrating in the dentin from one tubule into another in side branches. (Fig. 13.) The leukocyte here is in the calcified part of the dentin and changes direction through a side opening of the tubule. In Figure 14, the leukocyte extends into three side branches, or communications, of the original tubule. This would not be possible if the leukocytes were trapped in the dentin, and it can be explained only by active migration of the leukocytes into the dentinal tubules.

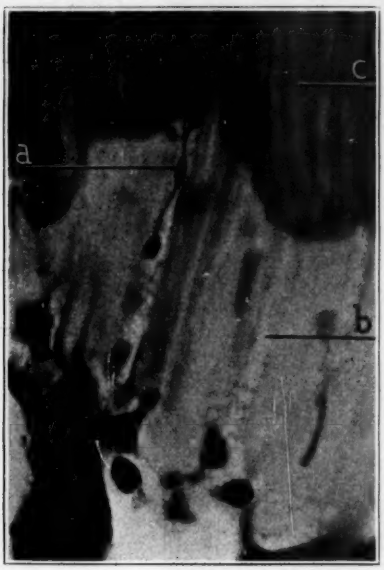

Fig. 12.—Leukocyte at a migrating into dentinal tubule, passing from uncalcified (b) into calcified part of dentin (c). Three lobules of the nucleus are connected by fine threads. This is typical of the polymorphonuclear leukocytes.

Of course, not every dark stained body found in the dentinal tubuli is a leukocyte. Under certain, not yet quite known, conditions, the fibrils in the dentinal tubules might take up the basophilic dye and give a similar appearance to these cells. However, in careful observation and consideration of all facts, a differentiation is not difficult. The farthest that I found leukocytes migrating into the dentin was about 0.25 mm. There was always an acute inflammatory reaction present in the pulp.

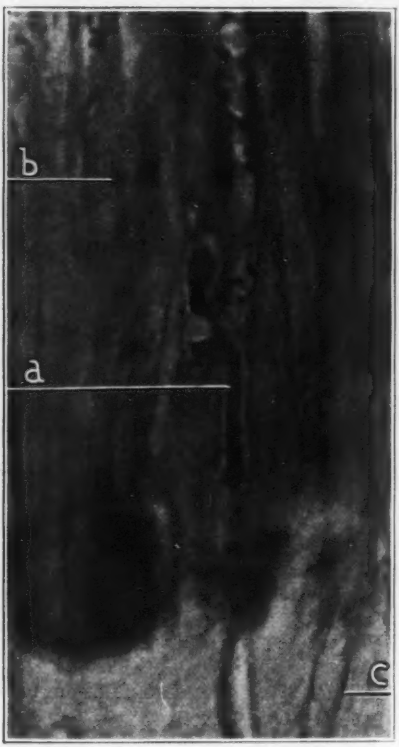

Fig. 13.—Leukocyte (a), migrating through side branch from one dentinal tubule into another. This cell is entirely in the calcified dentin (b). c, uncalcified dentin.

The question arises as to the cause or reason for migration of the leukocytes into the dentinal tubules. The supposition is that there is some kind of chemotaxis arising from the dentinal tubules. It is possible that, owing to irritation (heat

generated by cavity preparation, silver nitrate, eugenol, bacterial toxins, etc.), the protoplasmic processes of the odontoblasts are altered. Through disintegration of this cytoplasmic material, toxins develop which may produce the chemotactic condition. The leukocytes migrate to eliminate the products of degenerating cytoplasm. How the leukocytes will be able to operate when squeezed into the dentinal tubuli is a question. Probably, their activity will be reduced because of

Fig. 14.—Leukocyte (a) migrating from uncalcified (b) into calcified dentin (c). It sends out three branches, probably into three side branches of the dentinal tubule.

their limited space and decreased supply of energy. They do not get very far. About 0.25 mm. from the pulp was the greatest distance at which I could observe them. We often find in the dental tubuli, in regions of migrating leukocytes, dark round, or somewhat long, bodies in the tubuli (Figs. 1, 3, 11, 12, 13) which might be recognized as the remains of degenerating leukocytes. Owing to toxic influences, limited space and living conditions, they seem to degenerate and disintegrate. Their migration into the dentinal tubuli nevertheless should be recognized as an expression of defensive activity.

Having recognized this activity of the leukocytes, I was able to observe it again and again in different specimens, in caries and acute inflammation of the pulp. Further study will be necessary to show whether this activity of the leukocytes is present when there is definite specific irritation, such as heat generation in cavity preparation or silver nitrate application, or is to be seen in all acute inflammatory reactions. According to my observations up to date, any kind of irritation permanently damaging the odontoblastic processes may result in the reaction presented here.

In the literature, there are two references to the presence of leukocytes in the dentinal tubuli. Erdheim,[1] once famous pathologist of Vienna, in describing tissue changes in rickets, states that he found in the incisor of the rat fractures of the dentin. Around these fractures, an acute inflammatory reaction developed with massing of the leukocytes. According to Erdheim, a large number of leukocytes migrated into the dentinal tubuli of these fractured dentin pieces. However, he observed these leukocytes only in the uncalcified portion of the dentin and so drew the conclusion that this uncalcified dentin is softer than the calcified and thus permits migration of the leukocyte. My observation is that the leukocytes migrate far into the calcified dentin.

Another observation is that of Römer.[2] In his atlas, he shows leukocytes in the uncalcified dentin. However, he asserts that they have been trapped in the dentin. From the pictures available, we can believe that, in these particular specimens, such was the case, as the cells are round, and this is their original shape in blood

and tissue. In a paper appearing quite recently, C. H. Fischer[3] mentions the migration of leukocytes into dentinal tubuli after an inflammatory process destroyed the odontoblasts. However, he merely mentions the fact.

SUMMARY

Under the conditions of acute inflammatory reactions, leukocytes may migrate into the dentinal tubuli. This migration is probably due to some chemotactic condition arising from the degeneration of the dentinal fibrils or toxins from invading bacteria. Eosinophile, as well as neutrophile, leukocytes could be observed migrating into the tubuli. The cells elongate considerably so as to find a place in the narrow channels. Degeneration is probably their fate.

BIBLIOGRAPHY

1. Erdheim, J.: Contribution to Knowledge of Changes in Dentin Due to Parathyroidectomy. *Frankf. f. Path.*, 7:238, 1911.

2. Römer, O.: Atlas of Pathologic Changes in Dental Pulp. Freiburg I. B., 1909.

3. Fischer, C. H.: Contribution to Question of Future of Teeth Found in New-Born. *Deutsche Zahn.-, Mund.- und Kieferheilk.* 6: 501, 1939.

CHRONIC DESQUAMATIVE GINGIVITIS

By Sidney Sorrin,* D.D.S., New York, N. Y.

THE condition described as chronic desquamative gingivitis is one of the little understood clinical entities which the dentist is called upon to treat. A survey of the literature indicates that the etiology is not understood nor is there any known treatment empiric or otherwise that will cure these patients.

It is the purpose of this paper to review some of the literature on the subject of chronic desquamative gingivitis and to offer my own experiences and conclusions in the hope that some reader may shed more light on the etiology and treatment of this disease. For fifteen years, I have treated this disease with more or less success, yet, even in the more successful cases, little has been learned regarding etiology and treatment. During this entire period, ten cases have been carefully observed from both the systemic and the local point of view, yet no single etiologic factor was found present in all cases. Nor was any single treatment found successful in all cases.

An early description of the disease was given by Magitot, in 1868. He referred to it as "gingivite fungulouse," stating that "it is a form of inflammation which is characterized by a soft, flabby, irregular fungoid growth upon the gum tissue, which in its general aspects does not differ from the growth we observe during the process of healing of a wound in the mouth." (Prinz.)

Schech mentions a type of gum inflammation which he calls gingivitis sicca. (Die Krankheiten der mundhöle, 1869.)

Moral has furnished a very good illustration of the disease in his "Atlas." He speaks of it as "a widespread catarrhal gingivitis." (Atlas der Mundkrankheiten.)

Tomes, in 1859, speaks of "a singular modification of chronic inflammation of the gums, in which, instead of becoming thickened and irregular on the surface, they seem rather to decrease in size, as-

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sume a very smooth and polished surface and mottled aspect." He writes:

The malady is attended with acute intermittent pain, which may be confined to one side of the mouth, or even to half of the upper jaw. It very commonly comes on in the evening, and keeps the patient awake half the night. The patients suffering from this complaint for the most part seem to be poor middle-aged women in whom menstruation was becoming irregular, or had altogether ceased.

Goadby describes the disease as "characterized by bright red or scarlet gums and which commences insidiously by bleeding." He continues:

The disease shows no tendency to spontaneous healing and may remain present for

Fig. 1.—Chronic desquamative gingivitis in Italian woman aged 50. There are vesicles on the labial surface and dark red areas between these surfaces.

many years. The patient complains of a great soreness, total inability to take solid food when the disease is at its height, and even when the inflammation subsides. Highly spiced or acid foods may precipitate another attack of ulceration. In a well established case, the whole of the mucous membrane of the gums and contiguous portion of the cheek is bright red and injected. The disease does not tend to be confined to the gum margins, but affects the whole of the gum tissue equally.

Prinz has defined this disease as a chronic diffuse inflammation of the marginal gum tissue characterized by desquamation of the epithelium of the papillae and more or less of the adjacent gingivae, accompanied by a deep bluish redness of the exposed connective tissue, which readily bleeds on the slightest irritation. The highly inflamed gingivae are covered by sticky mucoid deposits. He says that the disease "manifests itself by an excessive fungoid growth of the papillae, together with an intense inflammation of the marginal gum tissue within the vicinity of the necks of the teeth." He adds:

The disease is primarily observed at the labio-buccal surfaces of the gingivae in both jaws; the lingual (palatal) region is rarely involved. It does not manifest itself in re-

Fig. 2.—Case shown in Figure 1; two months later.

gions from which the teeth have been removed.

Merritt says that he has "never seen a case with any noticeable odor to the breath," nor has he observed that "the lingual surfaces of the gums are only rarely involved." He says that "such involvement is less frequent but by no means uncommon." The fungoid growths have not been a prominent symptom in the cases that he has seen. He believes that "the disease is probably more common than is generally realized, for in its milder and less typical forms it may be confused with chronic gingivitis."

The term applied to the disease, chronic diffuse desquamative gingivitis, clearly defines the pathologic condition.

ETIOLOGY

"Nothing is definitely known about the causation of this disease. Bacterial investigation and Wassermann tests have proved to be negative. No history of syphilis could be elicited. A blood examination did not yield any further information." (Prinz.)

Bacteriologic examinations have, in some cases, revealed large numbers of fusospirochetal organisms, but their significance was found to be purely secondary.

Fig. 3.—Case shown in Figures 1 and 2; after two years. Improvement is evident.

Fig. 4.—Chronic desquamative gingivitis in a woman aged 27; labial view.

Blood dyscrasia and endocrine dysfunctions have been advanced as etiologic factors. Prinz suggests that since the disease is most frequently observed in middle-aged women in whom menstruation has become irregular or who are at the menopause, endocrine dysfunction should be considered.

Chronic desquamative gingivitis has often been confused with Vincent's infection. However, there is enough individuality to the disease for a differential diagnosis to be made. Prinz states that "the extreme chronicity of the disease, together with the persistent fungoid hypertrophy of the highly inflamed and desquamated papillae, which readily bleeds on the slightest touch, and which resists all local and general medication, are the outstanding diagnostic features."

SYMPTOMATOLOGY

In almost all cases, the course of the disease is the same. The patient first complains of a slight soreness around the necks of the teeth. The gums gradually thicken and become red. The inflammation soon spreads to the surrounding mucosa and the palate. About four or five days after the onset, all the involved tissues ulcerate. The ulcers begin to heal immediately after breaking open. As soon as healing takes place in one portion of the mouth, ulcerations develop in another part, and the condition becomes cyclic.

The disease may be described as a chronic diffuse inflammation of the marginal gum tissue characterized by desquamation of the epithelium of the papillae, and more or less of the adjacent gingivae, accompanied by a deep bluish redness of the exposed connective tissue, which bleeds on the slightest touch. The condition is rarely symmetrical and is never unilateral.

The symptoms found in desquamative gingivitis are numerous, and many contradictory signs have been mentioned, although basically they are alike. The one sign on which all investigators agree is

the fact that with desquamation the epithelial covering sloughs off, leaving a raw and sensitive surface. The color always lies between a bright scarlet and a bluish red, the involved area frequently presenting a polished and glistening appearance. Very often, the gingivae show a mottled surface. The gums, as in Vincent's infection, bleed when subjected to the slightest pressure, and the patient complains of pain and of having a burning sensation, which is greatly increased with the taking of solid or hot foods. Ice cream and other cold foods have no ill effect, and often are found to be soothing.

There are usually, but not always, additional symptoms. In many cases, the

Fig. 5.—Buccal view of case shown in Figure 4.

cervical lymph nodes are enlarged, and sometimes they are painful to the touch. Ulcerations may be present. The condition usually starts with the appearance of watery blisters, which break open and discharge their contents, leaving raw and painful surfaces, and then heal over, only to repeat the process. Merritt observes no odor to the breath. On the other hand, Prinz states that there is always a mildly offensive odor. Some writers speak of a general malaise, Goadby reporting an intermittent temperature of 101° F. Prinz mentions the fact that the severity of the disease depends on the general health of the patient. Goadby finds a mild diarrhea in many cases. In typical cases, there is a history of periods of comparative comfort followed by a relapse.

The disease is always present on the labial and buccal surfaces of the gingivae, and may be found on the lingual surface. All investigators, with the exception of Goadby, failed to find it in edentulous mouths. The condition always clears up after the extraction of the teeth in affected areas. Goadby cites one case wherein it reappeared under a denture. It is found in both normal mouths and mouths which show some periodontal disturbance. Periodontitis is rarely found in conjunction with chronic desquamative gingivitis. As has been stated, the disease is confined to

Fig. 6.—Case shown in Figures 4 and 5; one year later. Improvement is evident.

the middle-aged of the poorer classes and is found mainly in women who have reached the menopause.

Blum reported that a case which simulated the lesion developed into pemphigus. Of the ten cases which I have treated, none developed into pemphigus, and all the patients are alive.

TREATMENT

Each writer has offered his own technic of treatment, but later authors believe that a complete cure can be accomplished only by radical treatment; that is, through surgery. As early as 1859, the Tomes brothers reported successful treatment with mild aperients such as sulfate

and carbonate of magnesium. Later, Goadby recommended a non-irritating lotion, avoiding strong antiseptics. He believed that diet played an important rôle and so fed his patients fresh fruits and other antiscorbutic foods. He based this procedure on his belief that, in many cases, there was some blood dyscrasia. He also suggested that the patient be kept in bed as long as malaise was present. Goadby also believed that potassium chlorate therapy followed by a course of arsenic is the best treatment. When the disease persists for a long time, inanition

Fig. 7.—Chronic desquamative gingivitis, showing desquamation on lingual aspect of upper left third molar area.

usually occurs from the difficulty of taking solid food.

Both Prinz and Merritt write that the treatment suggested by Tomes and by Goadby is successful in mild cases, and, in severe cases, affords only temporary relief, but never a complete cure. Prinz prescribes mild astringents such as copper sulfate and zinc or chloride compounds for the less serious cases. In more severe cases, he resorts to surgery. His surgical technic is as follows: The teeth are completely scaled and curetted, regardless of the pain. Any pockets, along with the interproximal spaces, are then cleaned with a warm sodium perborate solution. The affected areas are now anesthetized and painted with Talbot's iodine. With special surgical instruments, he removes the diseased tissues, making sure that the marginal gingiva is completely festooned. The calculus now made visible is removed. Within two weeks, a new and healthy gingiva is developing. If any pinhead areas remain, they may be removed by cauterizing with a 10 per cent zinc chloride solution. Prinz states that the whole operation can be performed in one sitting, but that he personally prefers doing it in stages. The home care, which is essential, consists of the daily use of a mild antiseptic.

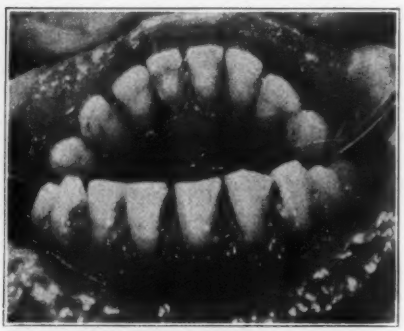

Fig. 8.—Desquamation on lingual aspect of lower central incisor region.

Miller and I reported a case of chronic desquamative gingivitis which showed much improvement after the use of acriviolet, thorough prophylaxis, an antiscorbutic diet and a sodium perborate mouthwash and careful use of the toothbrush. The patient was still in excellent oral health two years after completion of the treatment.

Hirschfeld reports having observed six cases, in most of which the symptoms appeared at or soon after the menopause. In a particular case, after six years of

treatment, there was no response and the case was dismissed. Approximately three years later, the patient reported, entirely cured. The condition had healed spontaneously and there has been no recurrence.

Merritt's treatment and surgical technic is somewhat similar to Prinz's. In mild cases in which desquamation and hypertrophy of the gingivae are subordinate symptoms, he suggests hygienic measures accompanied by the use of drugs such as tincture of iodine, copper sulfate and 5 per cent chromic acid. When surgical interference is indicated, the following is advised: The area to be operated on is anesthetized. A horizontal incision is made on the buccolabial surface beyond the limit of the diseased tissue. If there is any affected tissue on the lingual aspect, a similar incision is made lingually. The gums and gingival tissues are now removed between the incisions, and thus the alveolar process is exposed. It is at this time that the calculus is removed from all surfaces of the teeth. In healthy mouths, new gum tissue will replace that which has been removed, with no evidence of the operation and practically no recession remaining. However, if there is bone loss, naturally there will be recession. After the operation, the area is packed with a medicated cement such as zinc oxide and eugenol. This is allowed to remain for a week or two. After removal of the pack, the patient should start a regular system of massaging the gums to make them tougher and more resistant to disease. In serious cases, extraction of the teeth may be the only remedy.

AUTHOR'S OBSERVATIONS

The symptoms are easily differentiated from those of other oral lesions. In the main, contemporary observers agree. 1. In most cases, a vesicle appears on the labial or buccal gingivae. There may be one or more. (Figs. 1-6.) 2. The remaining tissue presents a red, mossy, velvety-to the-touch appearance, but desquamates readily. 3. Pain may be present. 4. The lesion rarely appears on the lingual surface, or in edentulous areas. However, I have observed it even in these areas. (Figs. 7-8.) 5. A fetid odor is usually present.

My further observations of ten cases treated over a period of fifteen years may be of some interest.

1. Nine patients were women from 25 to 65 years of age.
2. One patient was a man of 72 years.
3. All cases had the same symptoms more or less. In one case, vesicles and swelling appeared on the slightest touch.
4. The disease was confined to the gingival tissues and rarely involved the bone.
5. Pain was present in some cases.
6. All cases were given complete systemic and local check-up, and nothing could be found which was common to all or even a majority of cases. Blood and urine examinations revealed nothing unusual.

Pelzer reports that examination of the tissue (Fig. 4) with a capillary microscope revealed the following: polymorphonuclears, 65 per cent; lymphocytes, 32 per cent; monocytes, 2 per cent; eosinophils, none; basophils, 1 per cent. He also states:

> Examination of the gingival tissues with a capillary microscope revealed a definite deviation in tone of the small vessels. A larger portion of the top of the capillary loop was evident. The lumen was considerably enlarged and an abnormally large number of vessels were present in each field.
>
> The inner surface of the lower lip showed somewhat similar changes. The tone of these vessels was considered low, since similar dilatation was present and a flow of blood was discernible.
>
> Because of the condition of chronic desquamative gingivitis present, two explanations should be considered.
>
> (a) A greater expanse of vessels could be seen both on the gingivae and on the mucous membrane of the inner surface of the lower lip because of the relative absence of overlying epithelial tissue.

(b) A change of the tone of the small vessels had occurred, so severe in nature that a return to normal could not be effected.

7. Bacterial investigation of the diseased tissue revealed the ordinary flora of the mouth with no particular increase of any special micro-organism. Neither molds nor yeast could be demonstrated.

8. The report of the pathologic tissue shown in Figure 4 (the upper anterior region), which was forwarded to us by Charles G. Darlington, professor of pathology, New York University College of Dentistry, follows:

Macroscopic Description.—Ragged strip of gingival tissue.

Microscopic Description.—Section shows residual strips of epithelium and underlying tissue. Most of this specimen has been denuded of epithelium. Tiny strips which remain show a peculiar intra-epithelial vascularization; i.e., thin-walled endothelial-lined spaces form oval windows among the epithelial cells. The neighboring epithelial cells are often vacuolated. As a result, the pavement character of the epithelium has been lost. Cell outlines are blurred. Intracellular bridges are masked. In short, the epithelium appears boggy, waterlogged and edematous.

The underlying tissue is poorly fibrillar. Only in the deeper zones is the collagen coarse enough to stain clearly. Elsewhere, the tissue appears moth-eaten and edematous. Here too, the tissue is quite vascular, and tiny serving capillaries are dilated. The tissue is flecked with chronic inflammatory cells.

Pathologic Diagnosis.—Chronic desquamative gingivitis.

9. Treatment consisted of the employment of surgery, dyes, silver nitrate and iodine, chromic acid, arsphenamine and as many other drugs as have been reported in the literature up to this writing. However, no specific drug acted the same in every case. What was helpful in one mouth was of no assistance in another.

In the case shown in Figure 4, sulfanilamide was administered as a sore throat remedy, but it did not affect the oral condition. The drug was given by mouth.

In the last three cases treated, progynon, a placental hormone extract, was employed topically, with no improvement of the cases. From twenty-five to thirty treatments of thirty minutes each were given. A special holder was constructed to keep the preparation in close contact with the tissue. In these cases, Dr. Ziskin suggested that stronger units might well have been employed and for a longer period of time.

Surgery, employed in these cases, rendered temporary relief, but the condition returned in a milder form.

10. In two of the cases, which are at present under observation, drugs, progynon and excision were employed, but the most satisfactory results were secured from the use of beechwood creosote and iodine, a preparation suggested by Robin Adair as a pyorrheic dressing in his book "Practical Oral Hygiene, Prophylaxis and Pyorrhea Alveolaris." The instructions are as follows:

> Take one ounce chemically pure iodine crystals. Pour over this just enough chemically pure beechwood creosote to cover crystals of iodine. Let stand for forty-eight hours, then stir thoroughly with glass or wood rod, making a thick mixture. When this is settled, pour off from sediment at bottom.

After this was applied to the tissues, it was covered with glycerite of tannic acid. Definite controls were established within the mouth and only one part of the mouth was treated at a time with the drug. One patient was a man of 72, the other, a girl of 25. All other local treatment was followed. A woman 60 years of age has not as yet responded to the use of beechwood creosote.

11. Menopause could not have been a factor in more than 50 per cent of the cases. The paucity of such cases would indicate that menopause does not play a rôle in the etiology.

12. Allergic tests proved negative in seven of the cases.

13. None of my cases developed pemphigus.

14. Complete endocrine check-up gave little information regarding the etiology.

SUMMARY

1. Both men and women may suffer with this condition.

2. A most characteristic sign is desquamation of the epithelial tissues, which leaves a raw bleeding surface.

3. The disease is confined to the gingival tissues and rarely involves bone.

4. It may be found on labial, buccal and lingual gingivae. However, it does not appear so often on the lingual gingivae as it does in other regions.

5. Pain may be present.

6. A fetid odor is usually present.

7. Careful local or systemic check-up has revealed no condition which might lead one to suggest at this time any one etiologic factor present in all cases.

8. Beechwood creosote in iodine (Adair treatment) seemed to be helpful in the last two cases treated.

9. At the present time, I am experimenting with prontylin (sulfanilamide), applying this agent topically to the affected parts by making a paste with water.

CONCLUSIONS

It is strange that other parts of the body do not present similar changes in chronic desquamative gingivitis. More study on the saliva, blood and urine might reveal the factors in the disease.

The review has been presented with the hope that some one, somewhere, is successfully treating these cases and has found one etiologic factor in the condition and has also found an agent which will cure it.

BIBLIOGRAPHY

MERRITT, A. H.: Chronic Desquamative Gingivitis. *J. Periodontol.*, 4:30-34, January 1933.

TOMES, C. S.: Manual of Dental Anatomy, Human and Comparative. Ed. 4. Philadelphia: P. Blakiston, Son & Co., 1894, p. 683.

GOADBY, KENNETH: Diseases of Gums and Oral Mucous Membrane. Ed. 4. New York: Oxford University Press, 1931, p. 29.

PRINZ, HERMANN: Chronic Diffuse Desquamative Gingivitis. *D. Cosmos*, 74:331, April 1932.

SORRIN, SIDNEY, and MILLER, S. C.: Practice of Periodontia. New York: Macmillan Co., 1928, p. 115.

HIRSCHFELD, ISADOR: Toothbrush—Its Use and Abuse. New York: Dental Items of Interest Publishing Co., 1938.

BLUM, THEODOR: Pemphigus. Unpublished data.

ZISKIN, D. E.: Hormonal Therapy for Some Gingival Conditions. *J. D. Res.*, 18:329-341, August 1939.

NOGUÉ, R.: Maladies de la Bouche. Paris, 1924, p. 92.

SCHECH, P.: Die Krankheiten der Mundhoehle. Leipzig, 1896, p. 13.

MORAL and FRIEBOES: Atlas der Mundkrankheiten. Leipzig, 1924.

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RÔLE OF THE ORAL SURGEON IN THE DETERMINATION OF MOUTH INFECTION, INCLUDING THE PRESENCE OF PULPLESS TEETH, IN RELATION TO SYSTEMIC DISEASE

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"THE one great objective in the life of a dentist should be to save teeth." This and similar quotations are typical of a great deal of dental oratory. I disagree with the statement quoted. If there is one great objective in the life of a dentist, it should be to place the mouth of his patient in a condition of health. All else is secondary. General health and life, when they depend on such a condition, are more important than all the teeth in the mouth.

Can disease in the mouth be a source of infection of other parts of the body? I should not have to answer that question before this group of oral surgeons, who are dealing with this problem, eliminating mouth infection and relieving patients of serious general conditions. Focal infection is not a fad, and it has not passed the way of the fads. It is still the most important problem before the dental profession. Furthermore, the competent oral surgeon is not becoming more radical in regard to the removal of mouth foci; neither is he becoming more conservative. The pendulum is not swinging first this way and then that. He has been following fairly closely the same procedures for many years.

Oral surgery is a specialty which stands midway between medicine and dentistry. The oral surgeon, in addition to his D.D.S. degree, has either an M.D. degree or has pursued postgraduate studies covering fields of medicine that have a relation to conditions which present themselves in the mouth. In addition to this basic study, he has usually obtained a varied clinical experience in this field before classifying himself as a specialist in oral surgery.

In the practice of his specialty, the oral surgeon is in close contact with both the physician and the dentist. Patients are sent to him for his cooperation in the elimination of infection that may be so-called "focal infection." Because of his extensive experience in the search for mouth infection, during which he has been continually examining mouths, interpreting roentgenograms, seeing the actual pathologic changes revealed by operations and noting the systemic results of elimination of mouth infection, the oral surgeon has developed a knowledge of the finer points in diagnosis.

A competent diagnosis is, of course, the first requisite to placing the mouth in a condition of health, and obviously this diagnosis must be based on a thorough examination.

Are most patients receiving a thorough examination and a competent diagnosis? From my experience, I should say that they are not.

A physician has a patient suffering from some general condition due to focal infection; and suppose this physi-

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cian is competent in his field and wants to be sure that the mouth is in a condition of health: he refers the patient to the dentist for a report on the condition of the mouth. What is the result in many cases? The dentist slides a mouth mirror over a few teeth, records the gaping cavities, taps a tooth here or there and asks, "Does it hurt?" This is his idea of a mouth examination, and he reports to the physician accordingly.

Other dentists are more advanced professionally. They refer the patient to an x-ray laboratory, and obtain from the laboratory a detailed "diagnosis," which has, of course, been made without a history or mouth examination, and this so-called diagnosis is relied on to determine the necessary dental attention as well as to furnish the basis for the report to the physician.

The dentists mentioned above are, of course, down near the bottom of the scale. They are still working on teeth, not on patients. They are not recognizing all of the disease conditions that are present.

The physician receives, as a result of the above-mentioned type of incompetent examination and so-called diagnosis, a report that the mouth is healthy, or that one or two scattered teeth that are hurting the patient should be removed, or that the dentist will place the mouth in a healthy condition. The physician accepts this diagnosis or accepts the dentist's word that he will place the mouth in a healthy condition, but the patient does not improve under the physician's routine treatment. Finally, the physician becomes suspicious and possibly orders all the teeth out, or maybe all those with gold crowns or large fillings, and if he luckily has hit upon the focus of infection, the patient improves rapidly. After several similar experiences, what wonder is it that the physician loses faith in the dental profession, and in many cases orders oral roentgenograms, interprets them to the best of his ability and tries to decide for himself which teeth should be removed? One can hardly blame him under the circumstances, but this method may result in just as much misleading information as that obtained from the types of dentists mentioned.

Now let us consider the procedure of the dentist higher up in the scale. This more competent dentist obtains full mouth roentgenograms, possibly including bitewing films, and insists that any suspicious areas be roentgenographed from other angles. He then makes a competent interpretation of these roentgenograms in conjunction with a thorough mouth examination and records every finding. He has the ability to recognize the most minute abnormal changes in the tissues. Briefly, the mouth examination includes tests for vitality of the pulps of all apparently vital teeth, a thorough exploration of the attachment of the pericemental membrane around all gingival surfaces, consideration of the occlusion and various other details. This dentist also records the history of any other abnormal mouth conditions and also the general physical condition of the patient.

This examination and diagnosis are the basis of the report to the physician, and we should expect that dentists of this caliber would have somewhat related ideas as to the procedures to be followed to assure the patient a healthy mouth.

This class of dentists, however, must be subdivided roughly into two main groups, each of which has ideas diametrically opposed to the other's as to what constitutes mouth health.

One group proceeds from a technical standpoint entirely. All pain is stopped; all soreness is eliminated; all abscessed teeth are treated; all pyorrhea pockets, regardless of their depth, are treated, and so on. In other words, comfortable masticatory efficiency is obtained.

This type of dentist makes a compe-

tent mouth examination and diagnosis, but he too is still working on teeth, not on patients. He recognizes all the disease conditions that are present, but fails to realize their danger to health, or honestly believes that his procedure avoids this danger. The competent physician receiving reports from this type of dentist eventually considers himself forced to make his own diagnosis and give his own orders.

Now let us consider briefly the procedure of the other group, those who make competent examinations and diagnoses, but who *do* realize the seriousness of mouth infection. This type of dentist removes all abscessed teeth, realizes when so-called pyorrhea has progressed to the stage where it cannot be corrected by treatment and removes teeth thus involved or resects the gum tissues where this is feasible. From a preventive standpoint, he discusses the advisability of eliminating all pulpless teeth, especially those that are not valuable from a restorative standpoint, even though the patient is not a victim of systemic infection. He also appreciates the significance of minor conditions which, though harmless in most patients, can be a cause of very serious systemic trouble. There should be no doubt in any one's mind regarding the value of the report that the physician receives from this type of consultation.

Which of all the dentists so far discussed is recognizing his health responsibilities, raising dentistry to a higher standard and helping avoid the situation in which physicians order oral roentgenograms, interpret them to the best of their ability and decide for themselves which teeth should be removed? The answer is obvious.

Let me mention here that there is no one better qualified than the oral surgeon to make such examinations and recommendations, but this is a phase of work which many of us ignore. In my estimation, it is one of the most valuable services that can be rendered to the patient.

Now to consider in greater detail some of the points previously mentioned.

ROENTGENOGRAPHIC INTERPRETATION

I shall quote from the booklet prepared by the American Society of Oral Surgeons and Exodontists, "Disease Conditions of the Mouth and Their Relation to Health." This booklet is invaluable in educating the laity, and every member should have copies of it in his reception room.

Dental radiographs are usually necessary to determine whether the teeth are affected by chronic abscesses or other disease conditions. The teeth should be x-rayed periodically, and these pictures should show each tooth from at least two different angles. Because of complicated conditions, it may sometimes be necessary to take an x-ray picture of one tooth from several angles before a correct interpretation can be made.

As there are varying degrees of ability to interpret x-ray films, one should be discriminating in the choice of the specialist who is to render this service.

An interpretation of these pictures is not a diagnosis, but merely one of several important aids thereto. X-ray films are similar to shadow pictures. Although they furnish important information, the shadows do not always indicate all the conditions present. Many diseases of the mouth are not revealed in x-ray pictures, especially disease conditions limited to the soft tissues. Also, certain changes in the appearance of bone, as portrayed in the x-ray, are not always due to disease. For example, an x-ray film taken after the removal of a tooth, or after an operation on the jaw, will show a dark area, which might simulate an area of disease. Thus, we see that a diagnosis should not be made from x-ray evidence alone. Any one attempting to make a diagnosis on this basis may misinterpret healthy areas as diseased, or may overlook serious disease conditions. Such a *pseudodiagnosis* would be "worse than worthless." Because the x-ray picture cannot tell the whole story, the specialist must, before making a complete

diagnosis, thoroughly examine the mouth and obtain a history of the case from the patient.

A patient who wears upper and lower dentures (plates) is often amused when a dentist or physician advises an x-ray examination of his mouth. When the cause of systemic infection is being sought, it is just as important to take x-ray pictures of areas where teeth have been removed as of the regions where teeth are present. Statistics on extractions that were less carefully made than is now the rule prove that one out of every three jaws from which all the teeth have been removed harbors infection, impacted teeth or infected broken-off root tips. When a tooth is abscessed, the bone around the end of the root is diseased. When the tooth is removed, the diseased bone must receive the same consideration as infected areas elsewhere in the body. If not properly treated, the infection continues to spread through the jaw with no outward manifestations. In like manner, infection around retained fragments of decayed or broken-off roots, which were broken off and allowed to remain with the expectation that they might "work out," may spread.

Thus, it is apparent that periodic x-ray examinations should be made so that if a disease condition is revealed, corrective measures may be instituted early enough to prevent the impairment of the general health. Likewise, x-ray examination will also reveal the early stages of decay in the teeth.

I might add two points here: First, a pulpless tooth, even though showing in the roentgenogram a normal pericemental membrane, may have an area of bone destruction hidden behind the root because the line showing as the pericemental membrane is only one small portion of the membrane. Furthermore, in most roentgenograms of upper teeth, this line which appears to be at the center of the apex is actually at the lingual side of the apex. Second, charts of interpretation of roentgenograms received by the dentist and physician from many laboratories are made out by layman clerks, who know little of dental pathology, and who make these charts out on a wholesale production basis, one or two minutes to each.

COMPETENT MOUTH EXAMINATION AND RECORD CHART

Use a large chart with the entire outline of the roots of the teeth on it and preferably with an outline of adjoining structures.

1. Make a roentgenographic interpretation and indicate the following:

(a) Missing teeth, teeth tipped or moved because of loss of adjoining teeth, retained root fragments and unerupted or impacted teeth. Draw their position in relation to other tissues.

(b) Pulpless teeth which have root fillings. Draw the outline of any areas of apical bone destruction.

(c) Cavities or suspicion of cavities.

(d) Depth of destruction of the alveolar crest.

(e) Flat contact points.

(f) Overhanging fillings.

2. Test for vitality supposedly vital teeth and indicate the results on the chart. Designate the teeth that cannot be tested because of gold crowns, porcelain crowns or large fillings. At a later time, of course, these may have to be removed to allow a test to be made.

3. With a right angle explorer, or other suitable instrument, check the depth of detachment of the gum tissues (pockets) and mark this depth on the chart. This line of actual depth does not always agree with the roentgenographic interpretation of depth. Where an abnormal discrepancy exists, indicate on the chart the reason for this difference. The most overlooked areas of gum infection are: distal and distolingual of the lower third molar, distal of all the upper molars and the mesial of molars inclined because of early loss of adjoining teeth. The latter may have dangerous pockets even though the pericemental membrane is attached normally.

4. Verify in the mouth the roentgenographic interpretation of all flat contacts, overhanging fillings and cavities. Add those that did not show roentgenographically.

5. Note on the chart the amount of deposits and irritation of the gums, and include inflammation of the gums secondary to general systemic disease.

6. Indicate on the chart excementosis, curved roots, sclerotic bone and any other abnormal bone structure. Note any pertinent history.

7. When it is relevant, indicate on the chart the location of the floor of the nose, the sinus, the inferior dental nerve and the lower border of the mandible.

8. Record areas where malocclusion is causing obvious damage.

9. Note any other unusual or abnormal changes in the mouth.

10. Record briefly the general condition of the patient.

11. Mark for removal, unless inadvisable for specific reasons:

(a) Impacted teeth. Impacted cuspids in children may be moved into normal position.

(b) Pulpless teeth showing apical bone change.

(c) Teeth involved by so-called pyorrhea to the extent that, in your opinion, they cannot be made healthy by treatment or gum resection. Indicate where resection is sufficient.

(d) Retained root fragments.

12. Note any other necessary surgery.

This chart is, of course, more detailed than is necessary for routine purposes, but it will be found an invaluable aid to discussion of the case with the dentist or the physician and for comparison with later examinations.

After the chart is completed, the patient is given a mirror, the teeth that should be removed are pointed out and, in a few words, he is told of any other necessary procedures. He is then informed that the results of the examination will be incorporated in a letter to his physician, from whom he may get a copy if he so desires. We may then walk out of the operating room and have our assistant dismiss the patient, but invariably the patient wishes to ply us with questions, and we are given the ideal opportunity to educate him in regard to mouth health.

Now in our talk to the patient and in our letter to the doctor, what are we going to recommend and why? The answer is usually clear. Focal infection and pulpless teeth, however, warrant discussion.

FOCAL INFECTION

There is continual argument among different schools of thought as to whether infected teeth are actually a cause of infection elsewhere in the body. The dentist in the specialty of oral surgery, who is routinely relieving patients of serious systemic disease, may marvel that there should be any question about it, but let me quote Joseph L. Miller,[1] a man of international reputation in medicine, "It has not been proved that dental abscesses are responsible for systemic diseases." And again, "Schöttmüler, the German authority on sepsis, states positively that chronic root infections are innocuous." Such statements should make the oral surgeon realize that it behooves the oral surgeon to do some educational work. He will find stimulation to do so in Harry B. Johnston's[2] article, "The Improved Status of the Pulpless Tooth."

Considerable misunderstanding about the relationship of mouth infection to systemic disease is caused by the physician's telling the patient that a certain tooth is the cause of his systemic trouble and that removing this tooth will make him well. Such a statement should never be made, because the patient may not get well for several reasons: 1. The general trouble may not have been due to infection. 2. All infection in the mouth may not have been eliminated. 3. All focal infection elsewhere in the body may not have been eliminated. 4. Even if the infection originated in the tooth, it is now in the involved tissues elsewhere and Nature may have difficulty in overcoming it there. 5. Irreparable changes may have taken place to the extent that, even if the secondary infection is overcome, the tissues involved can never return to normal.

Occasionally, the systemic trouble spectacularly clears up after removal of the tooth. The reason for this is that Nature's remarkable curative abilities are given an opportunity to overcome the in-

fection because the continuous influx of bacteria is checked.

As mentioned before, however, irreparable changes may have already taken place. For example, the infection in a joint may clear up, but the joint never be normal again because it has degenerated so far that it has had established in it a vicious circle of other non-infectious trouble. But does that prove that the tooth was not the source of infection in the joint? No. And is that any reason why the patient should regret the loss of the tooth? No, because he has prevented all the other serious things that could be caused in the future by the infected tooth, and, at the same time, has checked further infection of the joint.

Please remember that when we are talking of infected teeth as a source of infection, everything that is said also applies to focal infection anywhere in the body. Discussion is limited to the mouth because that is our field and it is our business to see that the mouth is placed in a condition of health rather than to cure the patient of his systemic condition. In other words, when a patient who is suffering from a condition due to infection is sent to us, it is our duty to make the mouth healthy and that is all. But this is only one link in the chain of treatment of the patient. It is the physician's duty to see that all other focal infection is discovered and eliminated.

We are confronted almost daily with the question, "Why remove an abscessed tooth when it can be treated and made healthy?" We all know that even the largest abscessed area will get smaller on treatment of the tooth, but we also know that the same result will be obtained if the pulp canal is left open to the mouth. Such a result, however, does not mean that the tooth can no longer be a source of infection. Even though, as a microscopic curiosity, there can be reattachment of pericemental membrane, as a practical matter the cementum in that area is usually dead and acts as a foreign body. That is not a theory: it is a fact proved by examination of the apices of extracted teeth with a history of abscess. Dr. Johnston[2] says, "There is no known reason that infection should not be as easily conquered in this area as in any other part of the body." There *is* a known reason. Teeth are peculiar in structure and cannot be compared with any other part of the body because, unlike other tissues, they do not repair themselves.

The research man can prove repair, but only occasionally as a curiosity and not as a practical every-day occurrence. What happens most of the time is that Nature causes changes in the tissues in its attempt to protect itself from the infection. Nature's main efforts are expended toward resorption of the dead cementum in the reparative effort to eliminate this cementum from contact with healthy tissue. But Nature's endeavor to apply the principle of repair here is rarely successful.

Even if all infection could be eliminated by treatment, which is open to question, the tooth remains an area of lowered resistance ready to be reinfected with the first micro-organisms that pass that way. As regards this possibility, the point is raised that the pulpless tooth may be secondarily infected; for example, from an infected joint. What difference whether the tooth infection is primary or secondary, if it keeps sending infection into the system to keep Nature from overcoming the joint infection?

Another point raised is that bacteria are often found in the tissues around normal teeth with healthy pulps. We must allow for the great prevalence of contamination in making cultures, but, even so, we know that in almost every acute infection bacteria *do* circulate

through the blood stream to all tissues. In normal tissues, Nature can gradually dispose of such bacteria, but in abscessed teeth with dead cementum, where they find a protected nidus, the situation is decidedly different.

We often hear the argument that a patient has retained abscessed teeth for many years, during which time he has had the invaluable services of these teeth, and that, therefore, such teeth are not harmful. For every one person absorbing infection for many years with no apparent ill-effects, how many are in their graves prematurely because they allowed such a condition to exist? The fact that abscessed teeth have been retained many years does not mean that infective matter is not being absorbed into the system. It may be constantly absorbed and the patient must depend on the maintenance of the balance between the virulence of the infection and his resistance, and these vary continuously. The oral surgeon removes such infection mainly for the protection of the patient from the serious consequences of disturbance of this balance, and we cannot anticipate when this will happen. We must also remember that, in general, as a patient advances in age, his resistance decreases, and this balance is more easily disturbed.

It is true that bacteria may be held in check by the resistance of the patient and no apparent harm result for a long time, but the toxins of the bacteria are necessarily being taken into the system. Does this constant absorption of toxins have any bearing on the great prevalence of degenerative diseases, the causes of which are not yet known, that are encountered as the patient passes middle age? Such a relationship may some day be proved. At least, the resistance of the body to every abnormal situation is lowered by such toxins.

The foregoing discussion brings up the oft-repeated point that as long as there are no deleterious effects or, as Dr. Johnston expresses it, no "discoverable pathologic symptoms," why remove an abscessed tooth? Who knows, and by what means are they able to tell, whether the patient *is* experiencing deleterious effects?

Another contention is that so long as there are no clinical symptoms of pain or tenderness, abscessed teeth need not be disturbed. The frequent occurrence of extensive areas of bone destruction by infection from abscessed teeth without any symptoms ought to be sufficient proof that local symptoms have nothing to do with the question.

There seems to be a great deal of discussion as to whether abscessed teeth can do harm to the system, and yet there is no argument against the principle that it is dangerous to remove a large number of abscessed teeth at one time for fear of overwhelming the system with infection. I cannot reconcile these contradictory viewpoints.

I have attempted to refute some of the main points raised by dentists who would keep abscessed teeth in the mouth, and I could continue my refutations, but there is one further contention that I should not omit: the cry that masticatory efficiency will be ruined by the removal of all abscessed teeth, and that this will be more harmful to the patient than retention of the abscessed teeth. Such a statement is usually a confession of incompetency.

After consideration of all of the evidence with an open mind, the conclusion is inescapable, I think, that abscessed teeth are a menace, not only because of the possible transference of infection and toxins to other parts of the body, but also because of a general lowering of the resistance of the system to any attacks on its normal functioning. If, in the face of this conclusion, one risks leaving abscessed teeth in an adult mouth, he certainly should not risk leaving in

abscessed deciduous teeth. I plead that at least children be given every opportunity to develop healthy bodies.

Although I have discussed abscessed teeth in some detail, I have not meant to minimize the danger to health from two other sources. I refer to infection from so-called pyorrhea and from the region of impacted teeth with crowns that are in contact with the bacteria present in saliva. Many dentists and physicians fail to realize that these two sources are as dangerous as abscessed teeth.

PULPLESS TEETH

The pulpless tooth, with no demonstrable roentgenographic change in the pericemental membrane or the bone structure around its apex and with no clinical symptoms, in many cases does have an area hidden by the shadow of the root, and we do not know which ones are in this condition. For the sake of argument, let us assume that there is no change. Dr. Johnston[2] refers to "the indefinite and undependable evidence of animal experimentation," adding that "the realist knows that clinical evidence is the only scientific evidence." Let us accept this statement, and let me state that, in my practice, and I assume in yours, we are routinely eliminating general disease conditions by removing such teeth. This is our clinical evidence. This statement is made after due consideration of the fact that there is a fluctuating course of untreated disease and that the element of coincidence is involved.

Dr. Johnston quotes Krimsky as stating that some of the most virulent cases of infection involve x-ray negative teeth, but that there are always other symptoms which indicate the disease process. The latter part of this statement is not true, as we know by our daily experiences. For example, routinely, we see serious iritis rapidly improve after removal of just one roentgenographically negative pulpless tooth with no other symptoms. Many times, the iritis is 90 per cent better in twenty-four hours. I have seen a few cases show mobility of the iris within two hours.

There is no diagnostic means at our disposal which will enable us to determine whether any one such pulpless tooth, with negative roentgenographic findings and without clinical symptoms, is a menace to health and life. The roentgenogram does not show the virulence of infection and a so-called negative pulpless tooth may be a source of more virulent infection than an adjoining pulpless tooth which is involved by a large area of bone destruction. It is the virulence of the bacteria, not the amount of infection, that is the deciding factor. Therefore, no one can assure a patient that a pulpless tooth is not infected and is not a menace to health.

These facts influence me to the extent that I shall never permit a pulpless tooth to remain in my mouth nor in the mouth of any member of my family. I say this in answer to the insinuation that we are dishonest when we advise a patient to have pulpless teeth removed. Typical of these comments are the following: "Above all, let us be honest and frank with our patients. Let us do by them as we would be done by." "The dentist saving pulpless teeth has the backing of his conscience." "Stop and think what we would do if the patient were our mother, wife, sister or brother, and what would be the effect in the years to come"

I have always been conservative in my work. I never was a so-called "one hundred per center," nor am I now. When I do remove pulpless teeth in a healthy patient, it is not on the basis that they are doing the patient harm *now*, although they may be because, if bacteria are growing in such teeth, the toxins of the bacteria must be absorbed

into the system even if the bacteria themselves remain localized. One should remember in this connection that there may be considerable systemic harm before there are *apparent* symptoms of trouble. I am removing such teeth primarily as a preventive measure against the serious conditions which these teeth can cause and which teeth with healthy pulps, unless otherwise affected, cannot cause. Perhaps "prevention" was too forcefully emphasized in my earlier dental career.

The so-called conservative man accuses me of not regretting the mutilation of the patient when I remove a pulpless tooth. *He* is the one who should regret mutilating the patient when the latter develops a crippling disease that was caused by the presence of a pulpless tooth. He claims to create instead of destroy. I consider that he may be creating a source of infection which may destroy health. I hope that the following quotation from Dr. Johnston's article applies to me and to the other members of our society, "The true practitioner of the healing art considers the immediate and ultimate welfare of his patient first, and therapeutic measures second."

I am not trying to ridicule Dr. Johnston by quoting so much from his paper. I have used it because it was the best summary that I could find of the so-called conservative side of the question. Dr. Johnston is one of the outstanding dentists in this or any other country and his quotation truthfully applies to him. We merely disagree on the interpretation of some facts and on the basis for the advice that we give to our patients.

DEVELOPMENT OF MOUTH CONSULTATION BY THE ORAL SURGEON

Mouth consultation from an infection standpoint constitutes a large percentage of our practice, and it has been gradually built up through the years from three sources.

The most important source has been our patients, who have received this service with spectacular results, and have referred friends of theirs who have been treated by a physician for a long time without relief; or have been using home remedies to no avail; or have received the gist of the educational advice we have given, or have been having discomfort in their mouths that the dentist seemed unable to overcome. Thereafter, many of these patients come to us regularly every year for a mouth check-up.

The second most important source of patients for consultations is the physician who has discovered that from us he can obtain an unbiased diagnosis of the mouth. Some of these physicians insist that every new patient with a condition due to infection report to us for consultation. The eye specialist is very appreciative of a competent examination because mouth infection so slight that it is often overlooked is repeatedly the cause of eye infection.

The third source, from which the clientele is increasing rapidly, is the dentist who does not wish to assume the responsibility of mouth examination from a health standpoint. He sends the patient to us to eliminate all mouth infection and limits himself to the reconstruction work.

CONCLUSION

The field of mouth consultation is extremely important and should be given more consideration by the oral surgeon.

BIBLIOGRAPHY

1. Miller, J. L.: Dental Infection as Cause of Systemic Disease. J.A.D.A., 17:1598, September 1930.

2. Johnston, H. B.: Improved Status of Pulpless Tooth. J.A.D.A., 25:429, March 1938.

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DENTAL LITERATURE*

By O. W. Brandhorst, D.D.S., St. Louis, Mo.

THE dental profession is planning to celebrate its one hundredth anniversary in Baltimore, in March 1940. Historians, who have searched the records to outline the chronologic development of the profession, have agreed that three events mark the beginning of the dental profession; namely, the establishment of a national dental organization, the organization of a dental school and the creation of a dental publication. These three events form the tripod upon which the profession has been built.

Strangely enough, all of these events took place within a period of one year. Of them, William J. Gies writes[1]:

> Gradually the prospective value of cooperation for the elevation and advancement of dentistry, and for the consequent promotion of public welfare, became obvious, and several local societies were organized. Finally, in 1840, leading practitioners of dentistry established the American Society of Dental Surgeons, the first National Association of dentists. An important factor in this movement was the *American Journal of Dental Science*, the first journal of dentistry, which had been founded in 1839; and a strong influence in support of the development was the simultaneous inauguration of formal instruction in dentistry by the Baltimore College of Dental Surgery, the first school of dentistry. Within a period of practically one year, constructive leadership such as had never before appeared among dentists laid the foundations of publication, of organization and intercommunication, and of special education, on which has been based the modern evolution of the dental craft into the dental profession.

It must not be assumed that these new projects grew into their present usefulness without hardships. Like every venture, each of them has passed through many trials, and many times the outlook was very discouraging.

As it emerged as a profession, dentistry found that the commercial garb was not befitting its new position, and it was necessary to shake this off and take up the mantle of service. During the years that have elapsed, we have seen the profession gradually emerge from that first organization, in successive stages, through the American Dental Convention, the American Dental Association, the Southern Dental Association, the National Dental Association, into our present magnificent American Dental Association, in 1922. During this period, it passed through various stages of commercialism, including advertising, but finally came forth with a code of ethics for the guidance of its members.

In dental education, there was a similar experience. For a number of years, it was steeped in commercialism, but the survey of dental education by the Carnegie Foundation under the direction of William J. Gies, in 1926, pointed the way for a new alinement of the teaching institutions with universities.[2]

*Second of a series of three papers, on dental education, dental literature and dental organizations, to appear in successive issues of The Journal in timely accord with the plans for the centennial celebration, in Baltimore next March, of the establishment of dentistry as a separately organized profession.

1. Dental Education in U.S. and Canada, Bull. No. 19, 1926, p. 32.

2. Robinson, J. B.: A Literary Censorship. *Trans. Am. A. D. Editors*, 1937, p. 8.

It is said that a profession is known by its literature. In this field, we find that a number of books had been published on the subject of dentistry even prior to 1840. As early as 1548, Ryff published a book in German. In 1728, Fauchard published the first complete work on dentistry. The first American textbooks were published by Richard C. Skinner, in 1801, and B. T. Longbothom, in 1802. The first intercommunicating publication was the *American Journal of Dental Science,* founded in 1839.

J. Ben Robinson,[2] dean of the Baltimore College of Dental Surgery, whose many hours of research in dental history stamp him as an authority, refers to this periodical as

> . . . a splendid non-proprietary journal that is now and always will be regarded as a corner stone upon which our profession was laid, a journal of the profession, for the profession and by the profession and one that was fully equal to the then existing needs of the profession. That the proprietaries by entering the field of dental literature with a low-priced journal and invading the ranks of the profession to secure the fruits of achievement of prominent dentists were instrumental in eliminating the non-proprietary does not support the assumption that they contributed abundantly to the profession. . . .

The *American Journal of Dental Science* had "but one great object in view and that is the dissemination of useful and practical knowledge among Dentists." Its purposes were enumerated in its prospectus as follows:

"Such a work will have a tendency to expel from dental practice the quackery which disgraces it; . . . (will) give to distant parts of the country the benefit of all the theoretical and practical knowledge, which exists in our large cities; . . . (will) diffuse important kinds of information which is now local and limited; . . . (and will) have the effect of giving dignity and importance to the general subject of Practical Dentistry."

It was a recognized organ of the dental profession for the legitimate use of its members in recording their achievements for the benefit of all. For the values accruing from such a plan each subscriber was asked to pay a reasonable subscription to maintain the *Journal.*

A significant statement in the prospectus of the first number which will bear repeating here, is prophetic of what was to follow:

"If the members of the Profession, few in number compared with the patrons of other periodicals, do not subscribe liberally to the work, there is little probability that it can be long sustained."

While the patronage of the profession was at no time more than meagerly equal to the barest support of the *Journal,* even this soon waned and we find Chapin Harris, because of a devotion to his profession rarely seen in one of any vocation or calling, assuming the financial as well as the editorial burden of that fine *Journal.* It is sad to reflect that his loyalty to the Journal reduced Harris almost to penury and that he came to the end of a remarkably useful life destitute because he had given his all that his profession might be nourished.

During the years that followed, many publications made their appearance, some as official organs of dental organizations, others as publications by trade houses. The use of these publications as a medium for advertising for the supply houses became more and more common. Before long, the profession again found itself in the clutches of commercial influence, this time with regard to its literature. Periodic efforts were made to shake this off. William J. Gies saw the situation when he became interested in the dental profession and, in an address in 1916, stated[5]:

> Trade journalism in a profession is a form of vulgar autocracy. When it is benevolent, it pauperizes; when it is benignant, it patronizes; when it dominates, it demoralizes. Like autocracy, it exploits those who maintain it; it misrepresents those who trust it; it seeks to destroy those who challenge it.

Dr. Gies has been an ardent advocate of the control of dental journalism by the profession, for he recognized it as one of the prime factors by which the

profession would be judged. In this spirit, he launched the *Journal of Dental Research*, in 1919, and, for many years, he carried the financial responsibility of this publication because of his belief in dentistry as an important factor in health service. It is to the credit of the profession that an endowment fund for the *Journal of Dental Research* is now being raised to assure its continuance. In 1936, Dr. Gies turned over the journal to the International Association for Dental Research. There is no doubt that this publication exerted great influence in bringing about the recognition accorded dentistry by other scientific bodies.

The real battle for control of journalism by the profession followed the study made by the Commission on Journalism of the American College of Dentists, published in 1932, Bissell B. Palmer,[3] chairman, and, since that time, steady progress has been made.

Of the 124 dental publications today, 109 are listed as being under professional control, foremost among them being THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. Nearly all states now have their own publication.

Taking over the control of its journalism, however, has also placed responsibilities upon the profession. While it is true that much is written that is not worth printing, it is also true that much worth while material is written that yearns for a place for publication. The providing of adequate page outlet is, therefore, the responsibility and duty of the profession. It is our belief that there are in the profession men of sufficient vision and business acumen to solve this problem, and there remains only the need for encouraging the various interested parties to meet to develop plans for the solution of these problems.

3. Status of Dental Journalism in the U. S., 1932.

Besides the publishing of material, there is also the definite problem of creating reader interest. Unless this can be done, the printed material will not be generally read. The American Dental Association, several years ago, took steps that were intended to meet this situation, at least in part, when it established the Index of Current Dental Literature and the Library Bureau. These two efforts have gone far to make the printed material available to all members of the Association.

And yet the fact remains that, even with these facilities, many men do not have the urge to read. Perhaps an abstract journal might be a source of inspiration. If it were possible to create a reading habit through such a publication, any efforts involved would be worth while, for out of it would come an informed profession, which would demand the better things, not only for itself, but also for the public. Another desirable publication would be one like "Hygeia," which would serve to educate the public. There is no doubt that this could be made a very valuable asset to the profession in carrying dental health information to the public.

And so, on the threshold of the second century of dental progress, we look back over the trail traveled, thankful for the lift given us along our way and viewing the future with every confidence. An enlarged journalistic program under the control of the profession; increased facilities for publishing all worth while material and making it available to the profession; facilities for bringing our health message to the public; a greater reader interest, with a reading hour in the daily schedule of every member of the profession—these are the objectives toward which we turn our thoughts as we commemorate dentistry's centennial.

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A PRACTICAL APPLICATION OF THE PRINCIPLES OF PREVENTION

BOTH the dental profession and the medical profession have long since accepted the established principle of prevention as the ultimate aim and goal of disease treatment. And the absolute results from such an approach to the treatment of disease have been most graphically demonstrated in all diseases in which the etiology has been indubitably determined. In some diseases, however, the etiology is still obscure, and, ironically, a few of these diseases are not only the most serious, but also the most prevalent. It has therefore been necessary to accept a compromise, as it were, in the treatment of these diseases, and to apply the principle of prevention in the form of measures to control them at the first discoverable stage, because of the lack of full knowledge of their etiology.

In medicine, cancer is still beyond the application of truly preventive principles, and the medical profession has for years been marking time in the hope that the clearing up of its etiology would enable them to apply unreservedly the principles of prevention.

The same condition applies to the most intractable and the most prevalent of the diseases of the teeth—dental caries.

It has been necessary, therefore, for the profession to adopt whatever means promised the nearest approach to true prevention, and these measures have been numerous, each one offering a modicum of success toward the control of caries. One of the most effective means applied, and the one which has offered the greatest return as a practical application of prevention, has been the effort to control the spread of the disease through mouth hygiene, supplemented by operative procedures and methods of preventing the extension of the disease.

There have been numerous cases in which methods of control of caries in the mouths of patients have enabled the skilled dentist to carry many patients, in fact, whole clienteles, through the various caries-susceptible cycles to the point where few teeth have had to undergo extensive restorative procedures and few have been sacrificed. And, too, the measures and principles of practice thus intelligently and skilfully applied have enabled the dentist to care for a much larger clientele than he would have otherwise.

For example, there are many practitioners who have taken advantage of the ancillary service available through the dental hygienist for systematic prophylactic care of the mouth. This aid to dental practice has much relieved the demands upon the time of the dentist for restorative work and has enabled him to extend considerably the number of patients he could readily care for; and, too, such measures have saved much discomfort and expense to his clientele in what may be termed an application of the principles of prevention in materially retarding and controlling the destructive processes of caries.

In such practices, it has been shown beyond question that the earlier and younger a patient comes under the ministrations of the dentist, the greater have been the cumulative benefits of the application of the prophylactic measures. It is to the realization of the benefits accruing from early application of these measures that we attribute the growth of the popularity of children's dentistry during the past two decades. This, too, is another step forward from the earlier mechanical conception of the practice and purpose of dentistry, and toward the biologic conception, which, at the moment, appears to be in advance of the development of scientific knowledge.

The value of the application of the principles of prevention and control has been so definitely determined by many practitioners that it has become possible for them to predict with certainty the actual yearly expenditure of time and effort required to effectively maintain a healthful

and efficient masticatory apparatus throughout the life of the patient. In fact, the actuarial system and methods of the life insurance companies have been applied to the expectancy of dental attention in patients, and it has been determined that the amount of dental attention in later years is in proportion to and in relation to the age at which the patient came under the care of the dentist and to the skilfulness of the service received from the dentist.

A most convincing example of the assurance with which the amount of attention in future years can be predicted is presented in the present issue in a paper by Charles A. Sweet, in which the actual figures and results have been determined over a long period of years. So accurate are these figures and so assured are the results that the author has adopted what may be termed the insurance principle as applied to the care of the human mouth. In other words, he has been able to determine so accurately just how much of the dentist's time will be required in any future year to maintain the masticating apparatus at its highest efficiency that he can insure the patient against tooth inefficiency for a specified amount per year.

Think what it would mean to the public and to dentistry if all practices could be placed on such a safe and sound basis. We should not have to worry over the complexities of socialized health service, nor would we have to be so much concerned about the future of dental practice.

The adoption of the plan of practice under consideration or any plan which promises in any measure to meet the issue of prevalence of tooth decay need in no way reflect upon the efforts of those who are conscientiously endeavoring to solve the problem of dental caries in the most effective manner, namely, by discovering the cause of dental caries in order that it may be truly prevented. The method under consideration is but a sensible application of the knowledge that we have thus far accumulated. And not the least factor in the success of the practical application of prevention is the transference of as much of this knowledge to the patient as will enable him to cooperate with the dentist in his efforts to render intelligent mouth health service most effectively and efficiently.

The economic aspect of the intelligently controlled practice is another phase that offers much to both the patient and the dentist, and especially to the dentist in that it adds a factor of stability to his clientele that was lacking in many practices during the recent period of depression.

THE WAGNER HEALTH BILL

In another department of the present issue, we are presenting a statement from the National Health Program Committee announcing the abandonment by the present governmental administration of the intention to press the passage of the Wagner Health Bill in the present Congress.

This comes as welcome news to both the medical and the dental profession, as the proposed Wagner Health Bill contained much that was objectionable to those most interested in the health and welfare of the nation.

Coincidently with the announcement that the Wagner Bill was to be abandoned, the President announced the revival of the Interdepartmental Committee to Coordinate Health and Welfare Activities, with the return from retirement of Miss Josephine Roche to resume chairmanship of the committee. It will be recalled that the activities of this interdepartmental committee were largely responsible for many of the provisions of the Wagner Bill, and revival of the committee suggests new activities in health legislation. In fact, the President has intimated that the reason for abandoning the Wagner Bill is to give opportunity to study the question further and to formulate legislation that would in a measure avoid some of the deficiencies of the Wagner Bill as brought out at the Senate hearings on this bill.

While the threatened danger of overhasty legislative action relating to the health and welfare of the nation has blown over, we do not take this to mean that the danger has passed. The trend toward paternalism in political policies has become so firmly established that the issue of the national health will, we believe, be an uppermost objective of the politically minded for years to come; in fact, until some such provisions as were embodied in the Wagner Bill, however much modified, shall be incorporated into a national health bill; so that, even though less imminent, it is more certain that both the medical and dental professions will be called upon to meet the issue of provision of a health service that will more nearly meet the needs of the public. The present state of the issue, then, should serve as a period of study and development of ways and means to provide the basis upon which the health service of the future will be furnished. It is now encumbent upon the profession, as an earnest of good faith, to take steps voluntarily toward meeting a situa-

tion the seriousness of which was only apparent after political interests became involved.

The threat of objectionable health legislation has served the purpose, among others, of directing both medicine and dentistry to an introspective study of their faults and derelictions, which, in the end, we believe, will redound to the benefit of humanity and the professions involved.

'Tis an ill wind that blows nobody good, and one good purpose that the agitation about socialized health service has served is to arouse the health agencies to a realization of the inefficiency of present methods so far as all of the public is concerned. Both medical and dental service had almost become luxuries, available only to the well-to-do, and if the stressful period through which we have gone will, in a measure, reorient our conception of health service as an inherent right of all classes, it will have served an admirable purpose.

The National Health Program Committee of the American Dental Association has been busily engaged in championing the cause of dentistry during the long drawn-out, hectic discussion of the obligation of the professions to the public, and it has done much to enlighten the members of the Wagner Bill Senate Committee at the various hearings as to the important rôle which dentistry plays as an essential part of any health service which is comprehensive in its scope.

Our distinct obligation in any follow-up activities should be a more intensive campaign of education of the public and one that will carry to the public a realization of the benefits of dental service to the general health.

BIBLIOGRAPHICAL

Periodontal Diseases. Diagnosis and Treatment

By Arthur H. Merritt, D.D.S. Second edition. Cloth. 205 pages. 40 illustrations. Price $3.50. New York: The Macmillan Co., 1939.

The second edition of this work, which has has been almost entirely rewritten, is briefly and succinctly composed. This is an eminently practical book written as only a person with a vast clinical experience in the diagnosis and treatment of periodontal diseases could write it. The factual portion of the text begins with a short anatomy of the gingivae and the supporting structures of the teeth. This is followed by a section on the classification of periodontal diseases and the differential diagnosis of these maladies. Each of the gingival diseases is separately discussed, a description of the disease being followed by the pathology, etiology, diagnosis

and treatment. The treatment of the various conditions is entirely practical, consisting of a detailed description of the methods which have proved successful in Dr. Merritt's hands in the care of these conditions. There is a complete discussion of periodontoclasia and the methods of treatment available are here carefully evaluated. The entire subject matter is so lucidly and logically presented that it should serve as a convenient handbook to practicing dentists everywhere. The conversational tone and ease of reading the text, in addition to the conservative comments on the handling of these diseases, recommend its use as a textbook for dental students. The illustrations of roentgenograms appearing in this edition are not particularly suitable for showing bone regeneration. Whether reattachment of the detached gingival soft tissues takes place after subgingival curettage is, as Dr. Merritt indicates, a moot problem. Dr. Merritt believes that, under certain conditions, this does undoubtedly occur. What these conditions are, or how they may be controlled, is not discussed. In general, a statement of such prognostic importance deserves more detailed discussion. However, it is safe to say that if dentists were to follow the tenets of treatment as expressed by Dr. Merritt, the incidence of periodontal disease would be considerably reduced among the general population.

The Merck Index

Fifth Edition. An Encyclopedia for the Chemist, Pharmacist, Physician, Dentist and Veterinarian. Containing useful scientific data and other information on the physical, chemical and medicinal properties, as well as the various uses, of chemicals and drugs; also more than 4,500 chemical, clinico-chemical reactions, tests and reagents; formulas for preparation of culture media, fixatives and staining solutions; useful tables; antidotes for poisons; literature references. Compiled and published by Merck & Co., Inc., Rahway, N. J. Price $3.

The new Merck Index contains far more information than is to be found in previous editions of the work. While the book contains much information of value to the dentist, the descriptive material on several substances might well have been expanded to indicate dental uses more specifically. Dental uses for such substances as zinc oxide and rosin are not stated, although the substances are otherwise well described.

Contraindications and limitations of use of certain other substances are not fully given. In the description of sodium perborate aromatic, N.F., the use of this substance as a dentifrice, mouthwash and gargle is mentioned, and there is no mention of the limitations of its use. Limitations of the use of vinethene do not correspond precisely with those given in New and Nonofficial Remedies 1939.

Occasional errors in nomenclature, such as the use of the name larocaine instead of larocaine hydrochloride occur, but these errors are not numerous.

While a critical examination of the Merck Index leaves no doubt that Merck products are in general given favored consideration, it must be admitted that the Merck Index cannot be looked upon as another "house organ." For this, the firm is to be commended.

Viewed as a whole, the Merck Index is a valuable and worthwhile contribution to the technical literature.

Stedman's Medical Dictionary

By Thomas Lathrop Stedman, A.M., M.D., and Stanley Thomas Garber, B.S., M.D. Fourteenth edition. Cloth. 1303 pages. Price $7.50, with thumb index. Baltimore: The Williams and Wilkins Co., 1939.

This new edition of Stedman's well-known authoritative dictionary has been edited by Dr. Garber since the death of Dr. Stedman in 1938. In this volume, the superior qualities of the previous editions have been preserved. New titles and subtitles have been included in this work. Descriptions of the newer hormonal, vitamin and chemical compounds of therapeutic value have been incorporated. As in previous issues, the book contains many valuable charts and tables incorporating the B. N. A. nomenclature and the new British anatomic terms. This volume can be recommended as a complete index of medical terms.

COUNCIL ON DENTAL THERAPEUTICS

ANTIBACTERIAL EFFECTS OF THE ORGANIC MERCURIAL COMPOUNDS WITH SPECIAL REFERENCE TO THEIR USE AS GERMICIDES FOR THE STERILIZATION OF SURGICAL AND DENTAL INSTRUMENTS

By JOHN H. BREWER, Ph.D., Baltimore, Md.

(THIS article is presented as one in the Council's series on pharmacology and therapeutics. On behalf of the profession, the Council expresses appreciation to the author for his contribution.—HAROLD L. HANSEN, *Secretary)*

A search of the literature has revealed no carefully controlled work showing that any organic mercurial compound can be relied upon to kill the spores of anaerobic bacteria. Nevertheless, claims have been made that these compounds can be depended on for the sterilization of instruments, and great quantities of them are sold to physicians and dentists for that purpose. Nearly all of the germicidal claims made for such products were based on phenol coefficient tests, in which only *Staphylococcus aureus* and *Eberthella typhi* were used. No adequate tests were made with sporulating organisms such as *Bacillus anthracis, Clostridium tetani* or the group of organisms causing gangrene.

Claims for the cold sterilization of instruments and for sporicidal activity of the mercurials have found their way into many journals, textbooks and standard references. Much confusion has arisen in medical literature because certain fundamental principles have not been taken into consideration. This is especially true concerning mercurial antiseptics or disinfectants. For instance, mercuric chloride, as Abbott (1891) pointed out, is capable, in strong concentration, of killing *Staphylococcus aureus,* while, in very dilute solutions, it is only bacteriostatic. Thus, a compound may be antiseptic in concentrations too weak to be germicidal. Not only must the concentration of the active agent be considered, but the following factors must also be considered in choosing the proper term to describe a particular action: the time of contact, the chemical nature of the surrounding medium, the reaction (pH), the temperature, the number of organisms present in proportion to the amount of the chemical agent, the nature of the organism and the purpose for which the chemical is used.

For the experiments to follow, it was

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NOTE: This paper appeared in full in the May 20, 1939, issue of the Journal of the American Medical Association, p. 2009. Permission has been secured to reprint certain sections of special interest to dentists and the author was asked to rewrite intervening sections for the sake of continuity. The reader is referred to the original article for greater detail and the bibliography.

decided that pathogenic anaerobes should be chosen on the basis of their mode of attack on the body and the frequency with which they occur in nature. *Clostridium tetani, Clostridium septique* and *Clostridium welchii* were chosen. *Cl. tetani* remains localized in the tissues and kills entirely by virtue of its toxin. *Cl. welchii* and *Cl. septique* invade the tissues. *Cl. septique* may be found in large numbers in the pericardial and peritoneal cavities after fatal infection, and these infections are always characterized by a dark redness of the muscles and edema. In infections caused by *Cl. welchii,* the muscles are pale and are spongy, owing to gas formation. An important characteristic of the Clostridia, which is not often appreciated, is that all the pathogenic members are able to form spores in the animal body. (Topley and Wilson, 1936, p. 672.)

If one attempts to evaluate chemical agents for use on the skin or mucous membrane, to act either as antiseptics or as disinfectants, there are at once suggested many conditions that themselves tend to make it impossible to reproduce actual uniform conditions. Among these are tissue permeability and individual variation in the animals, including resistance and drug sensitiveness; and many other variants become apparent if one attempts such tests. In testing these chemical agents for instrument sterilization, however, there is no reason that the actual conditions cannot be reproduced to the finest detail. The procedure is entirely *in vitro,* with none of the variable elements of *in vivo* tests. Since this is true, there is no reason that the standard method for testing such chemicals should be based on any type test other than one which exactly reproduces the condition under which the chemical is to be used.

For the proper approach to the problem, it was thought wise to secure some reliable information concerning the actual use of these mercurials in the "cold sterilization" of instruments. Since the larger part of the surgical work done by physicians is carried out in hospitals where steam sterilization is accessible, chemical solutions are not used to the extent that they are in the dental field, where very little of the surgical work is done in hospitals. Nearly every dental surgeon must prepare for the sterilization of his own instruments.

DENTAL QUESTIONNAIRE TO DETERMINE ACTUAL CONDITIONS OF USE OF THE MERCURIALS

Before a study of the antibacterial effects of the organic mercurials used for disinfection of instruments was attempted, it was necessary to know to what extent these substances were used, the treatment of the instruments before and after attempting sterilization and how long they were left in the solution before being considered safe for use. With the aid of the Secretary of the Council on Dental Therapeutics of the American Dental Association, a questionnaire was prepared and sent to all class A and B dental schools in this country and the following dental clinics: Mayo Clinic, Section on Dental Surgery, Rochester, Minn.; University of Chicago Zoller Foundation Clinic, Chicago; The Forsyth Dental Infirmary for Children, Boston, and The Murry and Leonie Guggenheim Dental Clinic, New York.

In addition, the questionnaire was sent to a representative group of individual dentists over the country, some with large practices and others with comparatively few patients. Although only sixty-five questionnaires were sent out, the answers represent a cross-section of dental practice, since all of the dental schools are included.

Much thought was given to framing the questions in order that they might be clearly understood and that the answers might be comparable. In view of the definitions given earlier in this paper, some question arose as to the proper

word to be used in connection with the treatment of the instruments. Disinfection more adequately describes the actual accomplishment in most cases, but, at the time this questionnaire was circulated, nearly all the commercial solutions carried the phrase "for the sterilization of instruments." A large number of the publications on the subject deal with the chemical sterilization or chemical agents used for the sterilization of instruments. Seventy-one per cent of the dentists advocated the use of chemical agents for the sterilization of certain instruments, usually cutting instruments, scalpels, nerve broaches, tissue shears or instruments made of rubber or other material that would be damaged by boiling.

Sixty-three per cent of those making use of some chemical agent for sterilization use a mercurial. Metaphen, potassium mercuric iodide, Merax, Mercresin, Mercarbolide and Merthiolate were the mercurials used. Almost fifty per cent of those employing a mercurial used Metaphen Germicidal Solution (1:2500).

Two of the conditions known to influence the chemical disinfection of instruments are the preliminary treatment that the instruments receive and the length of time that they are allowed to remain in the solution. According to the replies, the time elapsing after the instrument was used until it was placed in the solution ranged from immediately after use to twenty-four hours or until the instrument was needed. The object of this question was to determine whether enough time elapsed for the blood and saliva to dry; in which case the instruments would be much more difficult to disinfect. Nearly all of those suggesting the use of any chemical agent thought it advisable to wash the instruments before placing them in the chemical solution. Several reported scrubbing the instrument with a brush or other scrubbing agent, and a few scrubbed them with soap.

There was great variation in the length of time that the instruments were left in the solution, the time varying from one minute to four hours. Almost every time in minutes up to thirty was suggested as the minimum for safety. Sixty per cent of those answering this question considered between ten and thirty minutes as the minimum time for sterilization. At the completion of sterilization, 44 per cent suggested drying on a sterile towel and placing in cabinets before use. The other treatments suggested were rinses in various sterile solutions, salines, boric acid or distilled water or alcohol, and drying in air.

Regardless of the value of a questionnaire as a means of obtaining reliable information, this one served to furnish the names of the mercurials actually being used and the fixed maximum and minimum time limits and gave information regarding the conditions of instruments when placed in the solutions. All this was necessary to designing experiments to simulate actual conditions of use.

THE MERCURIALS USED IN THE EXPERIMENTAL WORK

The list of mercurials to be used in the experimental work was made up of all those named in the answers to the dental questionnaire, together with those mentioned as agents that might be used as antiseptics or disinfectants, in the 1937 edition of New and Nonofficial Remedies. Included are a few that are new and have not been submitted to the Council on Pharmacy and Chemistry or at least not accepted at the present date. Some of the mercurials, owing to their dye content or for other reasons, are not suitable for use on instruments, and are not promoted for such purposes, but have been included because they represent different types of the organic mercurial compounds. Several inorganic compounds have been included, to act as controls, and some because they are still employed

to a large extent for the disinfection of instruments.

The mercurials used, with the pH, were:

Merthiolate, 1:1000 isotonic solution	9.8
Metaphen, 1:2500 aqueous germicidal solution	10.5
Merphenyl nitrate, 1:1500 boric acid solution	4.2
Mercarbolide, 1:1000 aqueous solution	6.5
Mercresin, tincture (only form available)	5.4
Mertoxol, 1:1000 isotonic solution	3.5
Mercurochrome, 1:50 aqueous solution	9.1
Meroxyl, 1:200, stabilized aqueous	7.1
Mercury oxycyanide, 1:6000 aqueous	9.1
Mercury cyanide, 1:1000 aqueous	6.2
Potassium mercuric iodide, 1:1000 aqueous	9.2
Mercuric chloride, 1:1000 aqueous	5.9

Since it is not the purpose of this work to compare the efficiency of the various preparations, except as to whether they are capable of accomplishing complete sterilization, no attempt has been made to keep the dilutions of the different mercurials constant. The rule generally followed has been to use the dilution suggested for instrument sterilization or, if the product is not advocated for this purpose, the dilution used has been that mentioned for disinfecting the skin or wounds.

One serious source of error in testing disinfectants with spore-forming organisms has been the fact that the method of cultivation before the test has not been conducive to spore formation, with the result that the tests have simply been made on vegetative forms, which were no more resistant than staphylococci or other vegetative organisms.*

*In the reprint obtainable from the author, the full bacteriologic technic for securing spores for these tests is given.

EXPERIMENTS WITH DENTAL BURS

As a result of the information obtained in the dental questionnaire, the following experiments were made. They follow in every detail the methods used by the physician or dentist in "sterilizing" his instruments. These experiments were made to determine whether the mercurials under actual conditions of use were capable of sterilizing the instruments when spores of some of the pathogenic anaerobes were used as the test organism. No originality is here claimed for this type of test. Nearly every hospital in which infection has occurred and the instruments were suspected has called upon its bacteriologic laboratory to make just such tests. The one object here has been to conduct the tests so that in case the organisms had not been killed, they would have the proper conditions for growth.

For the first series of experiments, dental burs† were sterilized in a petri dish in the hot air oven. These burs were removed with aseptic precautions, and the serrated cutting edges dipped in defibrinated blood to which had been added spores of one of the test organisms. The burs were then placed upright in holes in a rack made to fit inside a petri dish. The burs were covered with an inverted sterile spray dish. The transfer and dipping of the burs were accomplished with the aid of a pair of forceps previously sterilized and flamed between transfers. (Hill, 1920.) The contaminated burs then represented the contaminated instruments as they came from a patient's mouth, provided there had been loss of blood and the contaminating organisms had been present. The contaminated burs in the inverted spray dish were left at room temperature for varying lengths of time before being placed in the chemical disinfectant. One set was washed immediately (five minutes) after being contaminated, then placed in the

†Furnished by the Ransom and Randolph Co., Toledo, Ohio.

disinfectant. Sets of burs, that is one for each organism, were placed in the disinfectant after fifteen minutes, thirty minutes, one hour, four hours and twenty-four hours. This was to determine whether it made any difference at what time after use the instruments were placed in the disinfectant. It was thought that the drying of the blood might make mechanical cleansing more difficult and thus affect the sterilization.

Since most of the dentists thought it advisable to wash the instruments and some even to scrub them with a brush before placing them in the "germicidal" solution, it was decided to vary this procedure. Some sets of instruments were not rinsed at all, others were rinsed in sterile tap water and still others were scrubbed with a sterile brush and water until apparently clean.

Although the answers to the questionnaire placed the time for sterilization in the chemical solutions as from one minute to four hours, it was decided to use as the minimum time ten minutes, the minimum suggested by some of the manufacturers for the sterilization of instruments. In addition, sets of contaminated burs were allowed to remain in the various mercurials for periods of thirty minutes, one hour and twenty-four hours. Immediately after being removed from the sterilizing solutions, the burs were placed in 40 cc. of 1 per cent sodium thiosulfate for twenty-four hours, to neutralize any of the mercurial which might be present, as suggested by Meleney and Chatfield (1931). The burs were removed from this neutralizer, washed in 40 cc. of distilled water and transferred to infusion broth (40 cc.). They were then incubated in an anaerobe jar, from which they were removed when growth was noted. When growth was found, the organisms were identified to make sure that they were the same with which the bur had originally been contaminated.

The mercurials used were Merthiolate 1:1000, Metaphen Germicidal Solution, Mercresin and a 1:5000 solution of potassium mercuric iodide (Parke-Davis Germicidal Discs). This work was done in 1936, and these were the mercurials which were being or had been used for instrument sterilization by dentists and in dental clinics in Baltimore.

Although this work with dental burs represents seven months of experimental work and sixty complete experiments, a tabulation of the results would be of little value, for, in each instance, growth was obtained even after twenty-four hours' exposure to the disinfectant when the spores of any of the following organisms were used: *Cl. sporogenes, Cl. septique, Cl. tetani, Cl. welchii* and *Bacillus anthracis*.

The technic in these sixty experiments was varied so that some of the experiments simulated every possible combination which was suggested or actually used by the dentists. The mixture of the organisms with blood approaches conditions that are encountered in surgical practice.

Since, in dental practice, the instruments are not exposed to sodium thiosulfate, it was decided to repeat some of the experiments, omitting this treatment.

The burs were rinsed in distilled water after remaining in the mercurials for one hour and for twenty-four hours, respectively. They were placed in broth and growth of the test organisms was obtained in every instance. Mead (1930) found Metaphen incapable of killing *B. anthracis* and *B. subtilis* spores in one hour. He failed, however, to obtain growth after one and one-half hours. His method was to inoculate agar plates from the instruments after rinsing off the excess germicide. He incubated his cultures only forty-eight hours before making readings. Burke, Sprague and Barnes (1925) have shown that this incubation period is not sufficient. Meleney and Chatfield (1931) have shown that organisms which have been treated with

a disinfectant often do not grow out until fifteen days have passed, a maximum number growing out on the thirteenth day.

It is also to be expected that the practice of placing the instrument in the broth would yield a much higher percentage of positive results than simply dipping the instruments in melted agar. In actual practice, the instrument might be forced into the tissues and particles in crevices of the instrument would be removed that might not be dislodged by a simple dipping into agar.

EXPERIMENTS WITH DETACHABLE SURGEONS' BLADES*

Dental burs with deep grooves and serrated edges were chosen because they present lodging places for bacteria such as would also be found in the joints of hinged instruments. This would make mechanical cleansing more difficult and would tax the germicides to a greater extent. The use of these rough burs afforded no idea as to what the value of such solutions might be in the case of smooth instruments such as scalpels. For this work, detachable surgeons' blades were used. New blades from which the grease had been removed and others from which it had not been removed were used. These blades were used because they could be submerged in the medium and incubated for the duration of the test. The experiments with these instruments were made along with those on the dental burs, and in no instance were the results different; that is, growth was obtained in every instance. The conditions of testing and the mercurials used were the same as for the dental burs.

Two possible sources of error in this type of test are to be noted. In these experiments, the contaminating mixture should have been made with whole blood, for the bacteria would then have been entangled in the fibrin and might have been more difficult to remove from the instruments. In actual practice, the surgeons' blades are affixed in the handle. Many crevices are formed which fill with pus, blood and exudate of various kinds, and if actual conditions were to be approached, the blades should have been affixed to handles. Since positive results were obtained with the smooth blades and defibrinated blood, these facts are minimized, but had the organisms been killed in any instance, these would have been very important facts and should be borne in mind in experiments of this type.

After studying the results of the experiments with burs and detachable blades, it was realized that, although the experiments reproduced in detail the methods actually employed in chemically "sterilizing" instruments, certain bacteriologic technic was not above criticism, for reasons to be described later, and perhaps a true picture of the ability of the mercurial disinfectants had not been obtained. The technic of a group of experiments was outlined so that the action of the mercurials on the spores of several organisms could be tested. These experiments were designed to determine the action of the mercurials, not on spores entrapped in blood or dried in films in crevices surrounded by protein, but on naked spores in an excess of the mercurial. The closest attention was paid to bacteriologic technic so that actual conditions for killing and no chance of accidental contamination would exist.

To eliminate sources of error, an improved centrifuge technic† was developed to determine whether the mercurials under optimal conditions are capable of destroying spores of anaerobes. The outstanding features of this technic are as follows: A sealed tube is used in which the organisms are exposed to the chem-

*Furnished by the Surgical Blade Division of the American Safety Razor Corp., Brooklyn, N. Y.

†Given in full in the author's reprint.

ical agent for twenty-four hours. During this time, the mercurial spore mixture is agitated constantly to prevent evaporation "rings" and to insure complete wetting of the entire inner surface of the tube. Settling or layering of the organisms is also prevented. Animal inoculation, as well as cultural tests, were used to determine the efficacy of the various mercurials with this technic.

None of the mercurials was capable of killing the spores of *Cl. septique, Cl. welchii* or *B. anthracis,* even in the absence of body fluids, and under conditions optimal for the action of the chemical agents.

Cultural experiments indicate that some of the mercurials may affect the spores in such a way that, although not actually killed, they are no longer capable of causing infection.

The results of the cultural tests show that results based on a comparatively short incubation period are not reliable, since, in some instances, the treated spores developed only after twenty-four days.

CENTRIFUGE EXPERIMENTS; CONCLUSIONS

If these mercurials had been bactericidal, it would have been necessary to make many additional tests in order to prove the ability of the organic mercurials to disinfect instruments. Tests in the presence of various body fluids would have been made. Organisms dried in pus, whole blood, saliva, bile and in fact any fluid which might be found about the body in operations would have been necessary. These tests would be of little value, since it was shown that the mercurials were unable to kill the spores even in twenty-four hours in the absence of body fluids and other conditions that are known to decrease the bactericidal action of the mercurials.

The conflicting reports in the literature regarding the germicidal efficiency of the mercurials may be explained by noting that the methods of testing, in most cases, are not applicable to spore-forming organisms, in particular those tests which do not differentiate between actual killing and bacteriostatic action.

It is to be concluded, from the results of the tests described in this paper, that none of the mercurials examined can be depended on to sterilize instruments when spore-forming organisms are present. The question of disinfection is quite another problem. In the case of *Cl. tetani,* none of the mercurials rendered these spores non-infectious after twenty-four hours' contact. The spores were still capable of infecting the mice and producing tetanus. The spores of *Cl. septique* and *B. anthracis,* however, could be rendered non-infectious in certain instances; that is, although it was possible, in these cases, to recover organisms in cultural experiments, their injection into animals did not cause an infection.

The ability of some of the mercurials to act as antiseptics is beyond the scope of this paper. However, their actual germicidal value for vegetative bacteria is questioned. After finding that the mercurial solutions as commonly used are incapable of killing the spores of the pathogenic anaerobes in twenty-four hours, it was decided to determine their effect on some vegetative bacteria by the centrifuge method. Just as statements are made that some of these mercurials will kill spore-forming bacteria, it is stated by some of the manufacturers that their particular product will kill vegetative bacteria in ten minutes. One of the mercurials used did not kill *Staphylococcus aureus* in thirty minutes, although no neutralizers or special recovery methods were used.

Other vegetative bacteria were used and the results indicate that some method other than one based on phenol coefficient determination should be used to establish the ability of the mercurials to disinfect instruments.

Although it was found that the mercurials available on the market are not germicidal for the pathogenic anaerobes,

it is possible that one of the newer organic solvents, wetting agents or surface tension reducents might affect the spores in such a way that the mercurials would then be able to kill these organisms.

The method of testing used in the experimental work is not suggested as a standard method to be used for testing chemical agents for sterilizing instruments, but is proposed as a method for determining the action of chemical agents on spores under the most favorable conditions. The object of the method is to eliminate all possible sources of error by insuring the action of the chemical on every spore for the full length of the period of exposure.

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Dentifrices*

Carley's Tooth Powder: Composition: See Graver's Tooth Powder (A.D.R. 1939, page 112).

Manufactured by C. J. Graver & Co., Cleveland, Ohio. Distributed by C. J. Graver & Co., Cleveland, Ohio.

Orrin's Tooth Powder: Composition: See Graver's Tooth Powder (A.D.R. 1939, page 112).

Manufactured by C. J. Graver & Co., Cleveland, Ohio. Distributed by Stineway Drug Co., Chicago, Ill.

Pogue's Tooth Powder: Composition: See Graver's Tooth Powder (A.D.R. 1939, page 112).

Manufactured by C. J. Graver & Co., Cleveland, Ohio. Distributed by the H. & S. Pogue Co., Cincinnati, Ohio.

Local Anesthetics†

Bond Anesthetic Procaine Solution 2% with Epinephrine 1:50,000: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02000 gm.; epinephrine, 0.00002 gm.; sodium chloride, 0.00500 gm.; calcium chloride, 0.00040 gm.; potassium chloride, 0.00020 gm.; sodium bisulfite, 0.002 gm., and distilled water.

Manufactured by the Dental Products Company, Chicago, Ill. Distributed by C. L. Frame Dental Supply Company, Chicago, Ill.

Bond Anesthetic Procaine Solution 2% with Epinephrine 1:25,000: Each cubic centimeter is stated to contain procaine hydrochloride, 0.02000 gm.; epinephrine, 0.00004 gm.; sodium chloride, 0.00500 gm.; calcium chloride, 0.00400 gm.; potassium chloride, 0.00020 gm.; sodium bisulfite, 0.002 gm., and distilled water.

Manufactured by the Dental Products Company, Chicago, Ill. Distributed by C. L. Frame Dental Supply Company, Chicago, Ill.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information on the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

*A.D.R. 1939, page 108.
†A.D.R. 1939, page 38.

President's Message

THE DUES OF THE AMERICAN DENTAL ASSOCIATION: SHOULD THEY BE INCREASED?

THE success of the many activities carried on by the dental organizations of this country depends on the dues which these organizations receive from members. These dues are expended in the interest of the profession along many lines, such as (a) in life-long postgraduate courses in the form of many meetings each year; (b) in carrying on research, and (c) in protecting the profession and the public against imposition from the sale of untrustworthy materials and medicaments, and otherwise serving the profession as the individual practitioner cannot serve it.

Naturally these activities, *always carried on in the interest of the profession,* will be limited by the amount of income received. As a rule, the dues paid to the local dental society include membership in the state and national organizations. Dues vary in amount in the different states. Out of the dues, whatever they may be, $4 goes to the American Dental Association. Of this, $2.50 pays for subscription to THE JOURNAL, which is sent monthly to each member. This leaves a balance of $1.50 to be applied to the more than a score of expense items of the Association's budget, amounting to about 6 cents for each. In addition, there is income from advertising and a relatively small amount from investments. Total income from all sources for the current year is estimated at about $322,000. The membership at present is approximately 46,000.

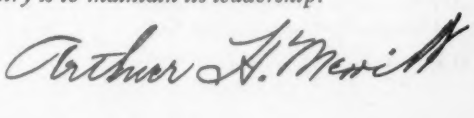
The American Dental Association is the only organization representing the dental profession of this country. It alone is the official spokesman of American dentistry. Its position involves many responsibilities which could not be undertaken by the individual members of the profession or by the smaller dental societies of the country. It is to the American Dental Association that the public naturally looks for leadership. When the federal government considers expanding its public health activities, it is to the American Dental Association that it must go for advice and guidance. When its presence is required in Washington, the Public Health Program Committee must remain there as long as its counsels are needed. It can hardly be expected to do this at its own expense. If a dental educational exhibit is to be provided for a world's fair or funds are to be made available for the Centenary of American dentistry, it is to the American Dental Association that the profession looks for assistance. This is logical, for these great educational enterprises cannot be financed by the individual practitioner or by the local or state dental society. In addition to current expenses, the American Dental Association has recently contributed $25,000 to these worthy projects.

This it should do, for these undertakings are obviously in the interest of both the profession and the public. The responsibilities of the Association along these and other lines increase each year and will continue to do so as dentistry comes to be recognized as an important factor in the health and well-being of the public.

In 1926, the expense items to be provided for in the budget were thirteen. Ten years later, they had grown to twenty-six, owing to the *increasing* and *legitimate demands* made upon the national organization—demands which could not be evaded, if it was to meet its responsibilities to the profession. Meanwhile, there has been no increase in dues; they are no larger than they were in 1926. A constantly growing membership has, for a time, made it possible to carry these added responsibilities. The point, however, has been reached where this increase in membership (which, to some extent, is continuing) cannot take care of present-day needs. This means that income must be increased or the activities of the American Dental Association will have to be curtailed. This year, the requests for funds to carry on the increasing responsibilities of the Association exceeded income by more than $50,000. Not only were these legitimate requests denied by the Board, but also funds had to be taken from surplus to meet a budget which could not be further reduced without serious impairment of its activities. These are some of the reasons that the House of Delegates will be asked to vote an increase of $2 in dues at the meeting in Cleveland next September.

The dues which we pay as compared with those paid by the medical profession are almost negligible. In one state of which I have knowledge, the physician pays for privileges enjoyed by the dentist in his local, state and national organization $41 a year—more than twice as much as is paid by most of the members of our organization. This is not an exceptional case. In certain states, I am informed by the president of the American Medical Association, the dues are considerably higher.

Unless the dues of the American Dental Association are brought into line with present-day needs, the organization cannot go forward with the activities which are clearly its responsibility and which cannot be carried on by any other dental organization. The additional cost per member is trifling—a little more than half a cent a day. Acting as individuals, we could do little for the advancement of dentistry with the $2 that we are asked to pay in additional dues. Collectively, the increase will mean nearly $100,000 a year added to the income of the American Dental Association. With this additional amount, it could and would greatly expand its activities. If we are not "penny wise and pound foolish," we will instruct our delegates in 1940 to vote for this much needed increase in dues. *It must be done if American dentistry is to maintain its leadership.*



ASSOCIATION ACTIVITIES

THE NATIONAL HEALTH PROGRAM COMMITTEE

THE status of legislation leading to a national health program was materially changed by an announcement of President Roosevelt in the closing days of 1939. During a press conference, the President let it be known that (1) he was proposing a new plan for the construction of hospitals wholly at federal expense; (2) the Wagner Health Bill would probably be "sidetracked" for the hospital-building program during the present session of the Congress, and (3) he was critical of those provisions of the Wagner Bill which required the matching of federal funds by the state because the poorer states with the greater need would be unable to take advantage of federal funds.

President Roosevelt also revealed that he had revived the Interdepartmental Committee to Coordinate Health and Welfare Activities and that Miss Josephine Roche, former Assistant Secretary of the Treasury, would emerge from retirement to become chairman. The Interdepartmental Committee was largely responsible, along with the Technical Committee on Medical Care, for the formulation of the National Health Program, which later became the basis of the Wagner Bill. The committee had not met in more than a year and its revival indicates renewed planning by the federal government, probably on a substitute for the discarded Wagner Bill. The personnel of the present Interdepartmental Committee is: Josephine Roche, chairman; Arthur J. Altmeyer, chairman of the Social Security Board; M. L. Wilson, Undersecretary of Agriculture; Thomas Parran, Surgeon-General; Aubrey Willia, National Youth Administrator; Oscar L. Chapman, Assistant Secretary of the Interior, and Charles V. McLaughlin, Assistant Secretary of Labor.

Most commentators agreed that these activities indicated that the Wagner Bill would not be seriously considered by the present Congress, but that efforts would be made to evolve a more satisfactory bill for use some time in the future. The comment quoted below is typical of those in the press following the President's press conference.[1]

> President Roosevelt today outlined tentative plans for a new federal spending program to be concentrated upon the construction of hospitals in impoverished communities which lack medical facilities.
>
> The hospitals would be small, one story, wooden affairs with an operating room, laboratory and about 100 beds to be built entirely at federal expense at a cost of about $150,000 apiece in communities where no hospitals of any kind exist.
>
> Instead of permitting Congress to determine where the hospitals are to be erected, he would seek authority to leave that decision in the hands of a group of medical men which he would name, he indicated.
>
> The features of the President's scheme were regarded here as highly significant: First, the program he outlined would sidetrack and perhaps kill permanently the socialized medicine programs which have been advanced by Senator Robert F. Wagner . . . and secondly, the plan would afford . . . a new opportunity to win support for a "pump priming" program.
>
> The President launched into his discussion of the hospital-building program by what

1. New York Sun, December 22, 1939.

was regarded as an unmistakable attack on the Wagner . . . proposal.

[The Wagner Bill] for the creation of a system of socialized medicine under a health insurance plan, he declared, would be tremendously costly to the federal government, and [it] also had the disadvantage of requiring state contributions on a dollar-matching basis. This, he said, would mean that the states with the most money, and consequently with the least need for improved medical facilities, would be enabled to enjoy the largest measure of benefit from the federal program, while impoverished states, badly in need of these facilities, would be able to obtain relatively little benefit from the federal-aid plan.

In answer to a direct query, he declined to characterize his own program as a substitute for the Wagner Bill, but referred to it rather as a modest beginning on a national health program that would develop as time goes on.

He made it clear, however, that, as far as he is concerned, he expects that the introduction of the hospital-building plan will cause the Wagner Bill to be sidetracked for the duration of the coming session of Congress at least.

It is not thought likely at this time that the Lodge and Capper bills, both of which deal with measures for a national health program, will be given serious consideration during the present session.

The possibility remains, however, that entirely new legislation can be initiated at any time during the session. The events of the next few months will indicate in a more precise way just how much the President's new plan will alter the federal drive for a national health program.

THE PLATFORM OF THE AMERICAN MEDICAL ASSOCIATION*

THE American Medical Association advocates:

1. The establishment of an agency of the federal government under which shall be coordinated and administered all medical and health functions of the federal government exclusive of those of the Army and Navy.

2. The allotment of such funds as the Congress may make available to any state in actual need, for the prevention of disease, the promotion of health and the care of the sick on proof of such need.

3. The principle that the care of the public health and the provision of medical service to the sick is primarily a local responsibility.

4. The development of a mechanism for meeting the needs of expansion of preventive medical services with local determination of needs and local control of administration.

5. The extension of medical care for the indigent and the medically indigent with local determination of needs and local control of administration.

6. In the extension of medical services to all the people, the utmost utilization of qualified medical and hospital facilities already established.

7. The continued development of the private practice of medicine, subject to such changes as may be necessary to maintain the quality of medical services and to increase their availability.

8. Expansion of public health and medical services consistent with the American system of democracy.—*J.A.M.A.*, Dec. 2, 1939.

*The American Medical Association offers the "Platform" here presented as its answer to the efforts to socialize the practice of medicine.

COMPONENT SOCIETIES TO HOLD ONE HUNDREDTH ANNIVERSARY DINNERS ON MARCH 11

PLANS are now perfected which will enable every component dental society of the A.D.A. to celebrate the One Hundredth Anniversary of Dentistry on Monday evening, March 11, 1940.

One hundredth anniversaries occur but once in a lifetime, and we, in 1940, are extremely fortunate in having the privilege of participating in this occasion. Every dentist and every dental society is urged to make their meeting an outstanding community event.

The following letter, which is self explanatory, was sent to every component society officer December 30.

Dear Doctor:

By this time, you have received a letter from Arthur H. Merritt, President of the American Dental Association, and also from the officers of your state society, both referring to the plans which the A. D. A. has developed for commemorating dentistry's 100th anniversary.

The celebration really consists of the Centenary dinners in every district in the United States on March 11, 1940, and the celebration at Baltimore on March 18, 19 and 20, 1940.

Again, the purpose of the celebration is twofold: (1) to make the profession conscious of its centennial and its responsibilities and (2) to acquaint the public with the profession's progress. No greater opportunity to do this will come in our lifetime and we must make the most of it.

Briefly, the plan for March 11 centers around the activities in the districts and each district will, of course, have to work up a program in conjunction with the dinner that will meet the local conditions and demands. There are, however, certain features that we would like to see included if at all possible.

We have, therefore, briefly outlined a program as a suggestion for the occasion, a copy of which is enclosed. You will note that the A. D. A. Committee will supply the basic material in the main so as to make it more convenient for the local groups. This material should be supplemented with additional local material to give it interest and local color. Additions and alterations should be made to the suggested program to assure an interesting and pleasurable evening.

The A. D. A. Committee will supply material for radio talks, news releases and speeches for civic groups, high schools and elementary schools. Other material will also be supplied if the local society will only make known its wants.

March 11 should be an occasion for celebrating. The local public should be made conscious of dentistry's centennial and the extent to which the local societies wish to go in inviting the public to participate in the Centenary dinner is entirely up to them. It is suggested that leaders in the community, medical, civic, social, educational and political, be invited to the dinners, so that the public as well as the profession can participate.

We should not lose sight of the fact that the big celebration, with many essayists, exhibits, pageants, etc., will take place in Baltimore, Md., March 18, 19 and 20. Make March 11 the greatest local and March 18-20 the greatest national meeting ever held.

Please advise the A. D. A. Committee prior to January 25 of your plans to cooperate and do not hesitate to come to us for whatever material you may need or whatever help we can give you. At your very earliest opportunity, please fill out and return the attached sheet. By so doing, you will greatly facilitate the work of our committee.

Yours cordially,

The A. D. A. Publicity Committee
for the Centennial

LON W. MORREY,
HAROLD S. SMITH,
O. W. BRANDHORST, *Chairman.*

TESTIMONIAL DINNER TO ARTHUR H. MERRITT, PRESIDENT OF THE AMERICAN DENTAL ASSOCIATION

THE First District Dental Society of New York will tender Dr. Merritt a testimonial dinner in honor and appreciation of the eminent services which he has rendered to the dental profession and particularly the First District Society.

The dinner will be held at the Hotel Pennsylvania, New York, N. Y., on the evening of February 21; $5 per cover.

The Dinner Committee, under the chairmanship of Waldo H. Mork, 501 Madison Avenue, expects this to be a notable event in the history of dentistry and invites all the friends of Dr. Merritt to participate.

WHITE HOUSE CONFERENCE ON CHILDREN IN A DEMOCRACY

THE White House Conference on Children in a Democracy, the fourth in a series of children's conferences held during the past thirty years, was held in Washington, D. C., January 18, 19 and 20. Secretary of Labor Frances Perkins, chairman of the conference, presented a new eleven point program for the economic and spiritual welfare of the American child over the next ten years. Nearly 500 experts on child care, from every state and every territory in the Union, were in attendance.

Throughout the comprehensive program on eleven different subjects ran numerous suggestions that organized American citizenry should take over more of the load to help bolster the family, the foundation of American life.

The conference was divided into eleven separate division meetings as follows:

1. The Family as the Threshold of Democracy.
2. Economic Resources of Families and Communities.
3. Housing the Family.
4. Economic Aid to Families.
5. Social Services for Children.
6. Children in Minority Groups.
7. Religion and Children in a Democracy.
8. Health and Medical Care for Children.
9. Education Through the School.
10. Leisure-Time Activities.
11. Child Labor and Youth Employment.

Dental health for American youth was thoroughly discussed in the section on Health and Medical Care for Children. The Report Committee recommended more and better dental care during the prenatal, preschool and school period.

In the final report, which was adopted by the conference as a whole, it was stated that adequate support should be given to research as well as to direct service through public appropriation and private grants, since research underlies all advance in practical programs of health and medical care for mothers and children, and that research in the cause of dental caries is especially indicated.

DEATHS

Aicher, Francis J., McHenry, Ill.; Northwestern University Dental School, 1913; died December 5; aged 49.

Allen, Harold W., New Martinsville, W. Va.; University of Pittsburgh, School of Dentistry, 1928; died November 30; aged 34.

Bassford, A. M., Chicago, Ill.; George Washington University Dental Department, 1905; died November 26; aged 61.

Busby, Oscar E., Dallas, Texas; School of Dentistry, Tulane University, 1901; died December 21.

Cook, Clinton D., Chicago, Ill.; died January 15; aged 66.

Cryan, James Drennan, Berkeley, Calif.; University of California College of Dentistry, 1932; died October 15; aged 32.

Dunn, John Thomas, Sulligent, Ala.; Vanderbilt University, School of Dentistry, 1897; died November 8; aged 64.

Glass, A. W., Monmouth, Ill.; Northwestern University Dental School, 1901; died December 25; aged 65.

Johnson, Paul A., Detroit, Mich.; University of Michigan School of Dentistry, 1913; died November 4; aged 54.

Laughlin, Vernon W., Colorado Springs, Colo.; School of Dentistry University of Denver, 1905; died recently; aged 63.

McSwiggin, J. F., Victor, Iowa; University of Illinois, College of Dentistry, 1905; died September 17; aged 57.

Melaik, Naseef, Eureka, Ill.; Chicago College of Dental Surgery, 1904; died October 11; aged 63.

Miller, Dennis S., Sunbury, Pa.; Pennsylvania College of Dental Surgery, 1900; died July 22; aged 60.

Munster, John H., Port Washington, Wis.; Chicago College of Dental Surgery, 1892; died November 15.

Phillips, George P., Boston, Mass.; Harvard University Dental School, 1919; died July 9.

Rodolf, C. F., Tulsa, Okla., formerly of Madison, Wis.; Chicago College of Dental Surgery, 1897; died August 27.

Rosenblum, Joseph, New York, N. Y.; School of Dental and Oral Surgery, Columbia University, 1909; died September 10.

Sample, Willard S., McCamey, Texas; Western Dental College, 1901; died October 12.

Sharpless, William H., Hoboken, N. J.; School of Dentistry, University of Pennsylvania, 1906; died October 11.

Smith, O. H., Sycamore, Ill.; Temple University School of Dentistry, 1877; died August 6.

Stilley, Van Albert, Jr.; Paducah, Ky.; Vanderbilt University, School of Dentistry, 1918; died November 29; aged 42.

Sturgeon, Dwight Paul, Los Angeles, Calif.; North Pacific College of Oregon; died December 8; aged 40.

Trussell, C. W., Rockwell, Iowa; Johns Hopkins University, 1882; died November 5; aged 79.

Wadsworth, Henry P., Geneva, Ill.; Chicago College of Dental Surgery, 1887; died November 20; aged 73.

Wagoner, John Benjamin, San Antonio, Texas; Northwestern University Dental School, 1903; died December 22; aged 58.

Webb, George W., Kansas City, Mo.; Western Dental College, 1902; died November 28; aged 69.

Wielage, M. Francis, Miami, Fla.; Western Reserve University School of Dentistry, 1917; died October 25.

Wiggins, Hundley, San Angelo, Texas; Vanderbilt University School of Dentistry, 1892; died November 2.

Williams, George R. E., Chicago, Ill.; Chicago College of Dental Surgery, 1900; died October 21; aged 65.

Yeager, William N., Berrien Springs, Mich.; Chicago College of Dental Surgery, 1901; died recently; aged 69.

BUREAU OF PUBLIC RELATIONS

DENTISTRY IN THE NETHERLANDS EAST INDIES

ONE half the world does not know how the other half lives, but occasionally we get a glimpse that opens new avenues of fascinating speculation. The following letter from Mrs. R. M. Devin, missionary, stationed at Bethel Moluccan Mission, Amboina, Netherlands East Indies, offers just enough information to stir the imagination.

In anything we deal with here, we have at least three distinct groups of people: the wild, or savage, native, the Mohammedans and the tame or semicivilized native (so-called Christian). Then each island has a great number of Chinese, a few Arabs, etc. We notice many beautiful looking sets of teeth, especially among the Mohammedans, but in what state they might be if closely examined, it is hard to say. The Chinese have very poor teeth as they eat sweets and starches all day long, never giving their stomachs or mouths a rest except when sleeping. The hill tribes on most of the islands, including Ambon, often have no teeth at all across the front of their mouths. The first sign of teeth is the eye teeth. I have inquired as to the cause of this and always get the same answer: "They eat sago only." As I have not made any study of this I do not know how true it is.

I have no idea at what age the teeth first begin to decay, though the children and young people all seem to have teeth in front. I do not know whether these teeth are worn off even with the gums or have come out by the roots. We have noticed much pyorrhea, at least we suppose it is that . . . loose teeth, bright red gums. The uncivilized natives all wash their teeth in this manner: They gather up a handful of white sea sand, open the mouth and chuck it in, rub vigorously with their fingers, then rinse it out.

Many of the natives, both Christian and Mohammedan (women only) use the betel nut, or ciri. This makes their teeth very black, or dark brown, and they chew another native nut with it which makes their mouths a bright red. The spittal from this "cud" that they concoct looks exactly like blood. Our streets are covered with red blotches. The women all sit around a box of ciri and dip in, much as we all nibble chocolates or sip ice cream sodas back home . . . in that wonderful land, the good old U. S. A. At least I hope she's still on the map!

There is no such thing as a dentist in the Moluccas, unless one should so class a Chinaman or two, who observed a dentist at work in Makassar or Soerabaya, then returned to town with a few crude implements and began to work on their own class of people. We have one of these "toekang gigis" (worker of teeth) here in Ambon. As for a trained dentist, we have none. Formerly, a Dutchwoman, whose husband is an M.D., practiced here, but she has returned to Holland. Our closest dentist is in Makassar 600 miles away. We have often thought what an opportunity there is here for a good American dentist. Truly it would cost something to get here, but that fact would be offset by the kind of equipment required, for even the most antiquated would be brand new here. . . .

I am fortunate in being able to send you word of the Inland tribes of New Guinea, also to enclose a photo of some. A young missionary named Post has just returned from the Wisselmeeren, a section newly opened by the government, and he reports the natives there have fine sets of even white teeth. My husband says that the coastal tribes near Manokwari and also the Arfak Mountain tribes who have migrated to the sea coast seem to have good teeth. You

must realize that we work among these peoples only a few weeks at a time and have never thought of "teeth" in particular. I

Three girls of Wisselmeeren, interior of New Guinea. They have good teeth although their entire diet is a kind of sweet potato and wild hog meat.

myself am interested in noting peculiarities of the tribes and I will be glad to collect what information I can and send it on from time to time.

Long before I was a missionary, I was a mother and I have six very healthy, husky children of my own. Our eldest son, now 15 years old, has had such fine teeth from his infancy until now that he was often shown around the school room by nurses and doctors . . . and not because he ever washes his teeth. I no longer "harp" on the subject. . . . The girls have poor teeth that decay rapidly, and they are always scrubbing them . . . but I have noticed many times that when a child has a severe illness just at the time the second set of teeth is forming, say from the sixth to the eighth year, he often has crooked teeth, seeming to be crowded into a mouth too small for them. I mean an illness that retards the entire growth of the child. It has always seemed to me that the teeth were a certain size, but the child's mouth did not develop to the normal size for receiving them, because the whole body growth was retarded at this time. I took this up with a physician at one time and he just laughed at the idea. Nevertheless, in perhaps 50 to 100 children who have passed our way, we have noticed this condition. You might like to give consideration to the observation.

Please do not hesitate to ask any questions you like, or write again if you feel that we might be able to help you further.

Most sincerely yours,
(Signed) Edna M. Devin
(Mrs. R. M.)

OGLETHORPE UNIVERSITY CRYPT OF CIVILIZATION

For a number of years, Dr. Thornwell Jacobs, president of Oglethorpe University, Georgia, has been collecting and recording all of our essential knowledge for posterity. Using a process developed by Oglethorpe's archivist, T. K. Peters, Dr. Jacobs and his associates are preserving this material in a form that will fight time and dissolution for at least 6,000 years. The material will be sealed in a stainless steel moisture-proof crypt which will not be opened until 8113.

Records of every phase of our twentieth century life will be sealed in the crypt concerning our art, science, customs, costumes, fads, crazes, capital, labor and living conditions; great men and their achievements; sports, pastimes, wars; races, transportation, industrial developments; medical developments, and every other salient factor in American life.

Recordings are made by means of photographic images on tissue thin stainless steel strips. The strips will be incased in seamless metal receptacles which,

in turn, will be installed in glass and asbestos-lined cases. To further preserve the valuable records, the air will be removed from the crypt and replaced with enert gas. A stainless steel door will seal the contents, which, barring a natural catastrophe or vandalism, will not be viewed again until the crypt is opened 6,000 years hence, in 8113. At the invitation of the Oglethorpe University, the American Dental Association donated the film "Nature, Builder of Teeth." In 6,000 years, the American Dental Association will probably be extinct, and, who knows? teeth may be a thing of the past.

AMERICAN ASSOCIATION OF ORTHODONTISTS BUREAU OF PUBLIC RELATIONS

"Orthodontic Facts for Health Workers" is the title of a leaflet available February 1. It is published by the American Association of Orthodontists. Using the question and answer form of presentation, the leaflet covers many points about the subject matter that are frequently in doubt. Copies may be obtained by addressing Dwight Anderson, director, Public Relations Bureau, American Association of Orthodontists, 2 East 103rd Street, New York, N. Y.

The Bureau was instituted at the Kansas City meeting of the association in May 1939, for the purpose of interpreting orthodontics to key people in the health groups, rather than to the public generally. Its first activity was the distribution of reprints of an article appearing in *Parent's Magazine*, "Make Way for Even Teeth," by Jessie Whichard McKoy. In all, 50,000 copies were distributed among public health officials and nurses, executives of voluntary health groups, school administrators, dentists and pediatricians. Thus, information was provided to specially interested persons who were able to interpret the subject to others and had opportunities to do so. Wide and favorable reception of this material indicated the lack of rudimentary knowledge among persons whose activities in life make them, in a sense, the guardians of the health of children.

The work of the Public Relations Bureau grew out of a similar activity conducted by the New York Society of Orthodontists in the eastern states over a period of several years as a demonstration, before it was taken up by the national organization. The structural setup of the bureau combines the advantage of national supervisory authority with administration by a working committee in close touch with the director of the bureau. An executive committee performs the former function, with T. W. Sorrells, Oklahoma City, Okla., chairman, and George A. Barker, Seattle, Wash., and Frank Nicolai, Brooklyn, N. Y., members. Dr. Nicolai is chairman of the board of directors having charge of the execution of plans, with Joseph D. Eby vice chairman.

Other members are Norman L. Hillyer, Henry U. Barber, Jr., Sidney E. Riesner, J. A. Salzmann, Leuman M. Waugh and Glenn F. Young. All the members of the board live in or near New York, N. Y.

Plans call for the distribution of at least 100,000 copies of "Facts About Orthodontics for Health Workers." It is expected, with this document, to extend the work into the public school field, as well as the private school field, and to reach dental hygienists through their schools and societies, and parent-

Part of the 62-foot exhibit presented by the New York Institute of Clinical Oral Pathology which won first award in division A, Scientific and Health Exhibit, American Dental Association meeting, Milwaukee, July 1939.

teacher associations and federations of women's clubs through their appropriate committees.

The work of the bureau is the first organized effort to call the attention of educators, health authorities, physicians, dentists and the personnel of allied health vocations to the profession of orthodontics and its place in the general picture of child hygiene.

The director of the bureau is director of the Public Relations Bureau of the Medical Society of the State of New York. He has been employed in executive or consulting capacities by the National Tuberculosis Association, the American Public Health Association, the American College of Physicians, the American College of Surgeons and similar organizations.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY OFFERS SUMMER COURSES IN PUBLIC HEALTH

FULL-TIME school dentists will be interested to know that the Massachusetts Institute of Technology is offering a four summer course, beginning in 1940, in the field of school hygiene, public health and health education, leading to the certificate in public health (C. P. H.).

The following announcement regarding the course has just been released:

The certificate in public health (C. P. H.) with special emphasis upon health education, which has been offered for several years in regular sessions, will be offered to professional school health workers of distinct ability in the summer of 1940. Most students will take the work in four summers, but, by special arrangement, a student may complete the program in two summer sessions and the second semester of the following year. In general, it is expected that admissions will be limited to those having successful experience in some phase of the school or college health program. This program of study is also open to suitably qualified members of the staffs of health departments and private health agencies.

In order to be admitted to this program of study, the applicant must have a bachelor's or higher degree with a good academic record from an organized institution. He must have completed satisfactory courses in chemistry (inorganic and organic), anatomy, physiology, bacteriology and (except for doctors of medicine) education. Some students may be accepted although deficient in a single subject, such as bacteriology. Such a student may remove his deficiency either here or elsewhere, or, in case he has acceptable graduate credits in some other subject in this program, he may take the prerequisite in place of the subject. School physicians desiring to enroll in this program may substitute courses in education for those in pathology and communicable diseases. Graduate courses in education are available in the nearby School of Education of Boston University or in the Graduate School of Education of Harvard University. Information concerning these courses in education can be obtained from Prof. C. E. Turner.

St. Apollonia, the Patron Saint of Dentistry.

Photographic reproduction of the famous painting of Carlos Dolci (1670), which hangs in the Corsini Gallery in Rome.

The historical legend describes Saint Apollonia as the daughter of a heathen magistrate of Alexandria, Egypt. She is reputed to have espoused Christianity as the only religion that could satisfy and ennoble her life. She was persecuted because of her faith, and in punishment for her refusal to renounce her religion, her teeth were removed, one at a time. Upon her persistent refusal to renounce her faith, it is said, she was burned to death. In 300 A.D., this revered martyr was canonized as Saint Apollonia. For more than six centuries, her intercession has been sought by those afflicted with painful dental disease, particularly toothache.

DENTAL CENTENARY CELEBRATION
1840-1940

BALTIMORE, MARYLAND, MARCH 18, 19 and 20, 1940

THE CENTENARY CALL

To the Members of the American Dental Association:

In order that the Dental Centenary Celebration shall be of the worthy character that you would wish for such an occasion, the various committees have worked diligently, and they have wrought most effectively. Herewith, we submit for your consideration the program that has been prepared for the observance of the one hundredth anniversary of the founding of our profession.

This is to be a meeting of rare significance, commemorating as it will one hundred years of professional progress, dating from the printing of the first dental journal, the founding of the first dental college and the establishing of the first national dental society. Because these three powerful and substantial bases are the triad upon which we have built our entire professional structure, Literature, Education and Organization will be the basic features of the celebration.

The development of each of these fundamentals will be set forth in detail and the whole so coordinated that, for the first time, there will be presented by exhibits, by essays and by historical drama the complete history of the profession, as well as the outstanding achievements of contemporary dentistry. The Dental Centenary Celebration will be a meeting that cannot be duplicated.

It is, therefore, with justifiable pride that we call all members of the American Dental Association to meet at the shrine of dentistry, to pay fitting tribute to the founders of the profession and to gain knowledge and inspiration to carry forward the great work which these founders began.

ARTHUR H. MERRITT,
President, American Dental Association.

B. LUCIEN BRUN,
Chairman, Dental Centenary Committee.

PRELIMINARY PROGRAM FOR THE DENTAL CENTENARY CELEBRATION

FIRST MORNING SESSION

(Ford's Theatre)
MONDAY, MARCH 18

10:30 a.m.

Presiding Officer: B. Lucien Brun, General Chairman, Dental Centenary Celebration

Invocation
Right Rev. Joseph M. Nelligan

Addresses of Welcome
Hon. Herbert R. O'Conor, Governor of Maryland
Hon. Howard W. Jackson, Mayor of Baltimore
H. C. Byrd, President, University of Maryland

Address
William M. Lewis, President, Lafayette College

SECOND MORNING SESSION

(Ford's Theatre)
TUESDAY, MARCH 19

10:30 a.m.

Presiding Officer: Arthur H. Merritt, President, American Dental Association

Invocation
Rabbi Morris S. Lazaron

Greetings from the American Medical Association

Greetings from the American Pharmaceutical Association
Andrew G. DuMez, President

Greetings from the American Public Health Association
Edward S. Godfrey, Jr., President

Address
Thomas Parran, Jr., Surgeon-General of the U. S. Public Health Service
"Dentistry as a Health Service"

THIRD MORNING SESSION

(Ford's Theatre)

WEDNESDAY, MARCH 20

10:30 a.m.

ACADEMIC CONVOCATION

Academic procession

Invocation

Right Rev. Edward Helfenstein, Bishop of Maryland

Announcements

J. Ben Robinson, Dean, Baltimore College of Dental Surgery, Dental School, University of Maryland

Address

Raymond A. Kent, President, University of Louisville

"The Relation of Dental Education to the University Program"

Conferring of honorary degrees

H. C. Byrd, President, University of Maryland

Benediction

Recessional

THE SCIENTIFIC SESSIONS

(Fifth Regiment Armory)

Chairman: GEORGE M. ANDERSON

MONDAY, MARCH 18

ROENTGENOLOGY

(Room A, Basement Floor)

Howard R. Raper, Honorary Chairman.....Albuquerque, N. M.

Henry C. Fixott, Honorary Vice Chairman.....Portland, Ore.

George C. Karn, Secretary.....Baltimore, Md.

2:00 "Detrimental Biological Effects of Roentgen Rays"
By Walter S. Thompson.....Los Angeles, Calif.

3:00 "Roentgenological Examinations Are Fraught with Danger"
By LeRoy M. Ennis...Philadelphia, Pa.

4:00 "Roentgenographic Study of the Reactions of the Dental Pulp to Trauma and Complications Arising in the Trifacial Nerve"
By L. R. Main.....St. Louis, Mo.

FULL DENTURES

(Room B, Basement Floor)

Charles R. Turner, Honorary Chairman.....Philadelphia, Pa.

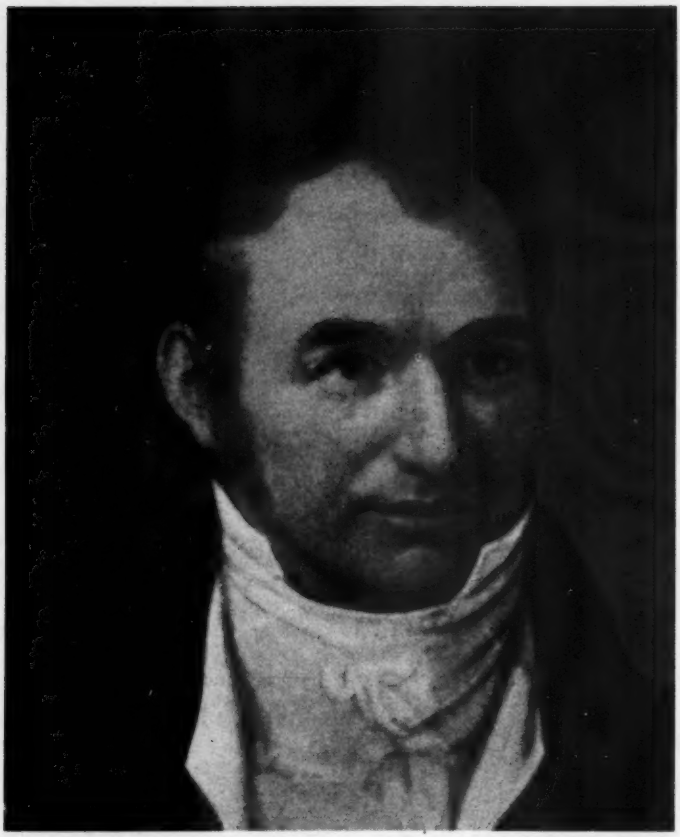
H. V. Cottrell, Honorary Vice Chairman.....Columbus, Ohio

Grayson W. Gaver, Secretary.....Baltimore, Md.

2:00 "A Century of Progress in Denture Base Materials"
By Rudolph O. Schlosser...Chicago, Ill.

3:00 "Factors in the Solution of a Constant Problem in Denture Service, Jaw Relations"
By Carl O. Flagstad..Minneapolis, Minn.

4:00 "Present Trends Which Threaten Prosthetic Oral Health Service of the Future"
By Walter H. Wright....Pittsburgh, Pa.



Horace H. Hayden (1769-1844)

Father and first president of the American Society of Dental Surgeons, the first national dental organization; cofounder and president of the Baltimore College of Dental Surgery, the first dental school; important force in the establishment of the American Journal of Dental Science, the first dental journal.

MEDICAL RELATIONS

(Room C, Mezzanine Floor)

William J. Gies, Honorary Chairman.....New York, N. Y.
Vilray P. Blair, Honorary Vice Chairman..St. Louis, Mo.
Arthur Lankford, Secretary...Baltimore, Md.

2:00 "The Medico-Dental Aspects of Allergy"
By Robert A. Cooke (M.D.).....New York, N. Y.

3:00 "Pains of the Head and Face of Non-Dental Origin"
By Walter E. Dandy (M.D.).....Baltimore, Md.

4:00 "Effect of the Endocrines on the Dental Apparatus"
By Isaac Schour.....Chicago, Ill.

OPERATIVE DENTISTRY

(Room D, Mezzanine Floor)

George W. Wilson, Honorary Chairman...Milwaukee, Wis.
Oborn G. L. Lewis, Honorary Vice Chairman.....Philadelphia, Pa.
B. Holly Smith, Secretary....Baltimore, Md.

2:00 "Function of the Operative Dentist in Conserving Teeth and Health"
By Robert E. Blackwell....Chicago, Ill.

3:00 "Evaluation of Recent Developments in Clinical Operative Dentistry"
By Harold E. Tingley.....Boston, Mass.

4:00 "Present-Day Silver Amalgam Alloys; Science of Development and Manipulation"
By Claude C. Cannon.....Fayette, Ala.

ORTHODONTICS

(Room E, Mezzanine Floor)

John V. Mershon, Honorary Chairman....Philadelphia, Pa.
B. Maxwell Stephens, Honorary Vice Chairman.....London, England
Harry E. Kelsey, Secretary...Baltimore, Md.

2:00 "The Diet of the Child"
By Edwards A. Park (M.D.).....Baltimore, Md.

3:00 "Objectives in Orthodontic Treatment"
By James D. McCoy..Los Angeles, Calif.

4:00 "Etiology of Malocclusion Considered from a Clinical Viewpoint"
By Harold J. Noyes.....Chicago, Ill.

DENTAL MATERIALS

(Room F, Mezzanine Floor)

Wilmer Souder, Honorary Chairman.....Washington, D. C.
Eugene W. Skinner, Honorary Vice Chairman.....Chicago, Ill.
J. Fred Emerson, Secretary...Baltimore, Md.

2:00 "Inlay Casting Procedure—Its Evolution and Manipulatory Variables"
By Philander B. Taylor..Cleveland, Ohio

3:00 "Non-Metallic Denture Materials—Their Development and Relative Merits"
By Horton D. Kimball....Detroit, Mich.

4:00 "Dental Cements"
By George C. Paffenbarger.....Washington, D. C.

TUESDAY, MARCH 19

ORAL DIAGNOSIS AND BACTERIOLOGY

(Room A, Basement Floor)

Weston A. Price, Honorary Chairman.....Cleveland, Ohio
Edgar D. Coolidge, Honorary Vice Chairman.....Chicago, Ill.
Harold Goldstein, Secretary...Baltimore, Md.

2:00 "Review and Further Studies of the Relation of Dental Infection to Systemic Disease"
By Edward C. Rosenow (M.D.).....Rochester, Minn.

3:00 "Problems in Oral Microbiology as Problems in Ecology"
By J. L. T. Appleton..Philadelphia, Pa.

4:00 "Case History in Oral Diagnosis"
By Daniel E. Ziskin....New York, N. Y.

REMOVABLE PARTIAL DENTURES

(Room B, Basement Floor)

Russell W. Tench, Honorary Chairman....New York, N. Y.
F. C. Elliott, Honorary Vice Chairman...Houston, Texas
Thomas J. Bland, Jr., Secretary.....Baltimore, Md.

2:00 "Effect of Abnormalities of Occlusion upon the Temporomandibular Joint and Associated Structures"
By Clyde H. Schuyler..New York, N. Y.

3:00 "Stresses Induced by a Partial Denture upon Its Supporting Tissues and Practical Means of Effecting Their Control"
By Oliver C. Applegate.....Ann Arbor, Mich.

4:00 "Practical Engineering as Applied to Removable Partial Denture Designing"
By N. G. Wills.....Connersville, Ind.

LOCAL AND GENERAL ANESTHESIA

(Room C, Mezzanine Floor)

Bissell B. Palmer, Honorary Chairman....New York, N. Y.
Richard H. Riethmuller, Honorary Vice Chairman.....Los Angeles, Calif.
Brice M. Dorsey, Secretary...Baltimore, Md.

2:00 "History of Anesthesia"
By W. Harry Archer....Pittsburgh, Pa.
3:00 "Principles of Anesthesia Related to the Practice of Oral Surgery"
By Malcolm W. Carr...New York, N. Y.
4:00 "Anesthesia in Modern Dentistry"
By Frank B. Hower.....Louisville, Ky.

CERAMICS

(Room D, Mezzanine Floor)

Albert L. LeGro, Honorary Chairman.... .....Detroit, Mich.
Carlisle C. Bastian, Honorary Vice Chairman .....New York, N. Y.
Ernest B. Nuttall, Secretary...Baltimore, Md.
2:00 "Basic Procedures Essential for Successful Porcelain Restorations"
By H. D. Grubb.....Cleveland, Ohio
3:00 "Porcelain Bridgework with Metal Reinforcements"
By Nye W. Goodman.Los Angeles, Calif.
4:00 "Porcelain as a Filling Material"
By E. Bruce Clark.....Pittsburgh, Pa.

EMBRYOLOGY, HISTOLOGY AND PATHOLOGY

(Room E, Mezzanine Floor)

Edward H. Hatton, Honorary Chairman.. .....Chicago, Ill.
Paul G. Kitchin, Honorary Vice Chairman .....Columbus, Ohio
Myron S. Aisenberg, Secretary.Baltimore, Md.
2:00 "Correlation Between Clinical and Pathological Diagnosis in Chronic Apical Periodontitis"
By Rudolf Kronfeld.....Chicago, Ill.
3:00 "Interrelation of Maturation and Histogenesis of Hypoplasia in Dental Enamel"
By Samuel W. Chase (Ph.D.)..... .....Cleveland, Ohio
4:00 "Histology: An Aid in the Treatment of Sensitive Teeth and the Desensitization of Dentin"
By Charles F. Bodecker.New York, N. Y.

PUBLIC HEALTH

(Room F, Mezzanine Floor)

Charles E. Rudolph, Honorary Chairman.. .....Minneapolis, Minn.
Frank C. Cady, Honorary Vice Chairman .....Washington, D. C.
Richard C. Leonard, Secretary..... .....Baltimore, Md.
2:00 "Dentistry: Its Purposes and Its Problems in Public Health"
By Leon R. Kramer.....Topeka, Kan.
3:00 "Dentistry in Public Health—A Problem in Research"
By Abel Wolman (Dr. Eng.)..... .....Baltimore, Md.
4:00 "Dentistry in Public Health—Opportunities and Responsibilities"
By O. W. Brandhorst....St. Louis, Mo.

WEDNESDAY, MARCH 20

ORAL SURGERY

(Room A, Basement Floor)

George B. Winter, Honorary Chairman.... .....St. Louis, Mo.
LeRoy M. S. Miner, Honorary Vice Chairman .....Boston, Mass.
Howard Van Natta, Secretary.Baltimore, Md.
2:00 "Oral Surgery and Its Relation to Dentistry and Medicine"
By Howard C. Miller.....Chicago, Ill.
3:00 "Surgery by the Dental Surgeon"
By Henry Sage Dunning..... .....New York, N. Y.
4:00 "Interrelation of Dentistry and Surgery in the Treatment of Deformities of the Face and Jaws"
By V. H. Kazanjian.....Boston, Mass.

FIXED PARTIAL DENTURES

(Room B, Basement Floor)

Edward T. Tinker, Honorary Chairman.. .....Minneapolis, Minn.
Stanley D. Tylman, Honorary Vice Chairman .....Chicago, Ill.
Walter L. Oggesen, Secretary..Baltimore, Md.
2:00 "Fixed Partial Dental Service—Problems and Trends"
By A. O. Klaffenbach..Iowa City, Iowa
3:00 "A New and Accurate Method for Construction of Fixed Partial Restoration Using Hydro-Colloidal Impression Materials"
By Karl W. Knapp....New York, N. Y.
4:00 "Modern Fixed Partial Denture Pontics"
By Irvin H. Ante.....Toronto, Canada

PRACTICE MANAGEMENT

(Room C, Mezzanine Floor)

Ralph R. Byrnes, Honorary Chairman.... .....Atlanta, Ga.
Allan T. Newman, Honorary Vice Chairman .....New York, N. Y.
Burt B. Ide, Secretary.....Baltimore, Md.
2:00 "Ideals and Principles in Practice Management"
By Albert L. Midgley..Providence, R. I.
3:00 "Five Phases of Successful Practice Management"
By Gaylord J. James....Cleveland, Ohio

Chapin A. Harris (1806-1860)

The leading figure in the founding and publishing of the American Journal of Dental Science; one of the founders and second president of the American Society of Dental Surgeons; cofounder and first dean of the Baltimore College of Dental Surgery.

4:00 "For Professional Services Rendered"
By Robert K. Brown..Ann Arbor, Mich.

PEDODONTIA

(Room D, Mezzanine Floor)

Harvey J. Burkhart, Honorary Chairman.. .....Rochester, N. Y.
Percy R. Howe, Honorary Vice Chairman .....Boston, Mass.
Myron I. Price, Secretary....Baltimore, Md.

2:00 "Child Health— A Dental Obligation"
By Walter T. McFall...Asheville, N. C.

3:00 "Fundamental Procedures in Cavity Preparation and Space Retention as Adapted to the Deciduous (Foundation) and Young Permanent Teeth"
By John C. Brauer.....Iowa City, Iowa

4:00 "Development of Dentistry for Children with Particular Reference to Root-Canal Therapy"
By John E. Gurley..San Francisco, Calif.

PERIODONTIA

(Room E, Mezzanine Floor)

Paul R. Stillman, Honorary Chairman.... .....Longwood, Fla.
Arthur H. Merritt, Honorary Vice Chairman .....New York, N. Y.
Glenn Carter, Secretary.....Baltimore, Md.

2:00 "Fundamentals of Parodontal Pathology"
By Kurt H. Thoma.....Boston, Mass.

3:00 "Treatment of Periodontal Disease in the Modern Way"
By Olin Kirkland....Montgomery, Ala.

4:00 "The Next Step Toward the Advancement of Dentistry Must Be Taken by the Periodontist"
By Bruce L. Taylor, Sr..... .....Washington, D. C.

MATERIA MEDICA, PHARMACOLOGY AND THERAPEUTICS

(Room F, Mezzanine Floor)

Hermann Prinz, Honorary Chairman..... .....Philadelphia, Pa.
William H. O. McGehee, Honorary Vice Chairman.....Washington, D. C.
Edward C. Dobbs, Secretary..Baltimore, Md.

2:00 "Biochemistry of Drug Action"
By Harold C. Hodge (Ph.D.)..... .....Rochester, N. Y.

3:00 "Progress of Pulp-Canal Therapy"
By James R. Blayney.....Chicago, Ill.

4:00 "A Century of Progress in Local Anesthesia in Dentistry"
By M. L. Tainter (M.D.)..... .....San Francisco, Calif.

VISUAL EDUCATION PROGRAM

MOTION PICTURES

(Fifth Regiment Armory, Room G, Mezzanine Floor)

Chairman: GEORGE M. ANDERSON

BALTIMORE, MD.

MONDAY, March 18—10:00 a.m.-5:00 p.m.

Committeeman in charge,
NORVAL H. MCDONALD, Baltimore, Md.

10:00 a.m. "Fractures of the Jaws" (Black and white)
Mayo Clinic, Section on Laryngology, Oral and Plastic Surgery
John B. Erich, M.D....Rochester, Minn.

10:45 a.m. "Imparting a Lifelike Appearance to Porcelain Jacket Crowns" (Color)
Carlisle C. Bastian, D.D.S..... .....New York, N. Y.

11:00 a.m. "Amalgam Restorations" (Color)
Arne F. Romnes, D.D.S., Northwestern University School of Dentistry..... .....Chicago, Ill.

11:45 a.m. "Bridgework" (Color)
Baylor University School of Dentistry, Dallas Texas

12:30 p.m. "Intra-Oral and Extra-Oral Injections" (Color)
Irving Salman, D.D.S., New York University College of Dentistry, New York, N. Y.

2:00 p.m. "Procedures in Oral Surgery" (Color)
Samuel Granof, D.D.S...Milwaukee, Wis.

3:00 p.m. A. "Tumors of the Jaw" (Black and white)
B. "Cyst of the Jaw" (Black and white)
Atlanta-Southern Dental College, Atlanta, Ga.

3:30 p.m. "Preparation and Construction of Upper Posterior Bridge" (Black and white)
J. Raymond Gill, D.D.S., University of California College of Dentistry, San Francisco, Calif.

4:30 p.m. "Moulage for Masks" (Color)
G. A. Petersen, D.D.S., and James E.

Bliss, D.D.S., School of Dentistry, Western Reserve University, Cleveland, Ohio

TUESDAY, March 19—10:00 a.m.-5:00 p.m.
Committeeman in charge,
H. BALDWIN STREETT, Baltimore, Md.

10:00 a.m. "Procedures in Operative Dentistry" (Black and white)
Department of Visual Education, University of California College of Dentistry, San Francisco, Calif.

11:00 a.m. "Technic for Construction of Anterior Fixed Bridge" (Color)
Robert P. Dressel, D.D.S., and James E. Bliss, D.D.S., School of Dentistry, Western Reserve University, Cleveland, Ohio

12:00 m. "Diseases of the Mouth" (Color)
Thomas J. Cook, D.D.S., Evans Institute, University of Pennsylvania, Philadelphia, Pa.

2:00 p.m. "Complete Maxillomandibular Extraction, Conduction Anesthesia Technic" (Color)
William P. Walker, D.D.S., University of Pittsburgh, School of Dentistry, Pittsburgh, Pa.

2:30 p.m. "Extra-Oral Injection of the Maxillary Nerve" (Black and white)
Levon M Saghirian, D.D.S., and Joel N. Novick, M.D., Philadelphia, Pa.

2:45 p.m. "Immediate Dentures" (Color)
University of Minnesota, Visual Education Department and School of Dentistry, Minneapolis, Minn.

3:30 p.m. "Oral Surgery Technic" (Color)
Berto A. Olson, D.D.S., and C. Fordyce Nelson, D.D.S., Hollywood, Calif.

4:00 p.m. "Dentistry for Children" (Color)
George W. Teuscher, D.D.S., Northwestern University School of Dentistry, Chicago, Ill.

4:30 p.m. A. "Myofunctional Studies in the Orthodontic Clinic"
B. "Technic of Taking Plaster Impressions for Orthodontic Record Models" (Black and white)
Temple University, School of Dentistry, Philadelphia, Pa.

WEDNESDAY, March 20—
10:00 a.m.-5:00 p.m.
Committeeman in charge,
FILBERT L. MOORE, Baltimore, Md.

10:00 a.m. "Technic for Making Full Upper and Lower Roentgenographic Examination" (Black and white)
J. C. Eshelman, D.D.S., University of Pittsburgh, School of Dentistry, Pittsburgh, Pa.

10:20 a.m. "Temporomandibular Articulation" (Black and white)
University of Iowa, College of Dentistry, Iowa City, Iowa

10:45 a.m. "Classification of Impacted Mandibular Third Molars and Technic for Removal of Impacted Teeth" (Color)
Glenn J. Pell, D.D.S., and G. Thaddeus Gregory, D.D.S., Indianapolis, Ind.

11:30 a.m. A. "Impression Technic for the Edentulous Mouth" (Color)
B. "Immediate Denture Technic" (Color"
Irvin H. Ante, D.D.S., Toronto, Canada

12:15 p.m. Guggenheim Dental Clinic (Black and white)
The Murry and Leonie Guggenheim Dental Clinic, John Oppie McCall, D.D.S., Director, New York, N. Y.

12:30 p.m. "Children's Dentistry" (Color)
University of Iowa, School of Dentistry, Iowa City, Iowa

2:00 p.m. "Preparation and Construction of Veneer Crowns" (Black and white)
J. Raymond Gill, D.D.S., University of California School of Dentistry, San Francisco, Calif.

2:45 p.m. "Construction of a Porcelain Jacket Crown" (Black and white)
Carl W. Hoffer, D.D.S. . . Nashville, Tenn.

3:15 p.m. "Apicoectomy" (Color)
Irving Salman, D.D.S., New York University, School of Dentistry, New York, N. Y.

3:45 p.m. "Presentation of a Case of Complete Anodontia" (Color)
Paul Geoffrion, D.D.S., Faculty of Oral Surgery, University of Montreal, Montreal, Canada

4:00 p.m. "Anatomic Dissection" (Black and white and color)
F. C. Elliott, Dean, Texas Dental College, Houston, Texas

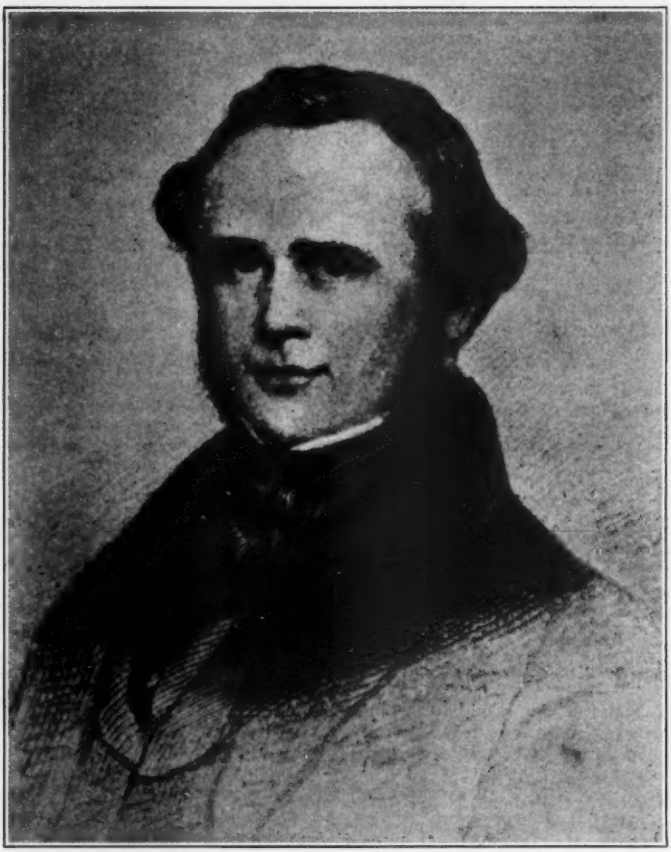
SOUND MOTION PICTURE

"Your Future in Dentistry"

Prepared by Thomas B. McCrum, D.D.S., and presented through the courtesy of the Kansas City-Western Dental College, Kansas City, Mo., R. J. Rinehart, Dean.

Committeemen in charge: Morris Cramer, Daniel E. Shehan.

This talking motion picture will be shown in the boys' high schools of Baltimore during Centenary week.



Horace Wells (1815-1848)
Discoverer of the greatest boon to humanity—Anesthesia.

HISTORICAL EXHIBITS

Monday, Tuesday and Wednesday, March 18, 19 and 20

(Main Floor—Fifth Regiment Armory)

Open to the public

Chairman: Alexander H. Paterson, Baltimore, Md.

9:00 a.m. to 5:30 p.m.

The section devoted to the historical exhibits will depict in detail the beginnings, the stages of development and the contemporary achievements of all the branches of the art and science of dentistry. This department of the celebration will present the most comprehensive and valuable display of dental matter ever presented.

This unique and completely correlated presentation of the progress of dentistry has been made possible only because of the significance of the Dental Centenary. Probably never again will our generation have the opportunity to view and study on one occasion the complete picture of dentistry in all its varied relations and conditions during its first hundred years as a profession.

The historical exhibits will be shown in the Fifth Regiment Armory, a spacious building with an exhibit floor 200 by 300 feet in area. The center space of the section will be occupied by an historical court. The feature of the court will be a replica of the first dental school. There will also be four operating rooms showing the evolution of office equipment through the century. In addition, there will be on exhibition many of the personal posessions of the founders of the profession.

Flanking the historical court will be booths 35 feet long, 7 feet deep and 8 feet high, in which the dental schools of the United States and Canada will present exhibits. Around these will be grouped the exhibits of allied dental organizations. Each dental school has been allotted a definite subject.

Batimore College of Dental Surgery, Dental School, University of Maryland: "Dental Education"
M. W. McCrea

"Four Operating Rooms Illustrating the Progress of Operating Room Equipment"
D. C. Danforth

Temple University School of Dentistry: "Ceramics"
Louis Herman

New York University, College of Dentistry: "Evolution of a Dental Office"
Charles G. Darlington

Washington University School of Dentistry: "Historical Specimens from Wolzendorf Museum"
B. E. Lischer

Harvard University Dental School: "Oral Deformities and Their Corrections"
Everett A. Tisdale

Tufts College Dental School: "Historical Exhibit"
L. Walter Brown, Jr.

University of Toronto, Faculty of Dentistry: "Dentistry in Canada"
F. J. Conboy

The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania: "History of Anesthesia and Surgery in Dentistry"
LeRoy M. Ennis

Kansas City-Western Dental College: "Oral Surgery"
R. J. Rinehart

University of California College of Dentistry: "A Pictorial History of the College of Dentistry, University of California and Its Treasure Chest"
Guy S. Millberry

Chicago College of Dental Surgery, Dental Department of Loyola University: "Oral Pathology"
Rudolf Kronfeld

Northwestern University Dental School: "Operative Dentistry"
J. R. Schumaker

Atlanta-Southern Dental College: "Instruments, Ancient and Modern"
L. B. Brown

University of Illinois, College of Dentistry: "Dental School Equipment"
Edward J. Krejci

University of Buffalo, School of Dentistry: "Partial Denture Prosthesis"
Hugh D. Quinby

Columbia University School of Dental and Oral Surgery: "Orthodontia"
Leuman M. Waugh

Ohio State University, College of Dentistry: "School Exhibit"
Wendell D. Postle

Medical College of Virginia, School of Dentistry: "Pharmacology"
H. B. Haag

University of Pittsburgh, School of Dentistry: "Full Denture Prosthesis"
Charles E. Friesell

Georgetown University, School of Dentistry: "Crown and Bridge Prosthesis"
Roy J. Glezen

University of Montreal, Faculty of Dental Surgery: "Historical Exhibit of Quebec's Dentistry"
P. E. Poitras

Texas Dental College and Baylor University College of Dentistry: "Texas Dentistry"
Joseph P. Arnold

School of Medicine and Dentistry, University of Rochester: "Basic Sciences, Now and Then"
Martin L. Deakins

The Forsyth Training School for Dental Hygienists: "Hygiene"
Percy R. Howe

The Eastman Training School for Dental Hygienists: "Hygiene"
Harvey J. Burkhart

United States Army Dental Corps, Medical Department: "Dentistry in the Army"
D. D. Ash

United States Navy Dental Corps, Navy Medical Center: "Dentistry in the Navy"
William L. Darnall

American Dental Association Research Fellowship, National Bureau of Standards: "Certified Dental Materials"
George C. Paffenbarger

American Dental Association, Bureau of Public Relations: "Public Relations"
Lon W. Morrey

American Dental Association, Council on Dental Therapeutics: "Therapeutics"
Harold L. Hansen

American Dental Association: "History"
L. Pierce Anthony

Henry Isaiah Dorr Research Laboratory, Temple University: "A Type of Therapy in the Treatment of Periodontal Disease"
Frederick James

Federal Security Agency, United States Public Health Service: "Health Service"
Norman Y. Hooper

Maryland Academy of Science: "Some Physical and Physiologic Phenomena in Light for Seeing"
W. D. Boynton

O. W. Brandhorst: "Dental Literature"

Morris Mestel: "Art Collection on St. Apollonia"

George M. Anderson: "The Art of Adalbert J. Volck, D.D.S."

HISTORICAL DRAMA

(Ford's Theatre)

Monday and Tuesday, March 18 and 19

Chairman: F. Noel Smith, Baltimore, Md.

8:30 p.m.

*Wilderness: A Cavalcade of the Profession of Dentistry**

The drama will be a cavalcade of American Dentistry, with Horace H. Hayden as the central and coordinating character. Beginning in 1780 with a scene laid in a field dressing-station near Yorktown, and ending in 1940 with a scene laid in a modern dental office, the story of the rugged road American dentistry has traveled will be told in twenty-five colorful and dramatic episodes. The blundering ignorance of the early itinerant practitioners; the leadership of the pioneers who accepted the challenge of scepticism and abuse; the worth and genius of the great characters who founded the dental triad of education, organization and literature—these features of dental progress form the highlights of the drama. Among the leading dental figures to be depicted are Horace H. Hayden, Chapin A. Harris, Joseph J. F. Le Maire, Josiah Flagg, James Gardette, John Greenwood, Robert Arthur, Horace Wells, John M. Riggs, Eleazar Parmly, John Lovejoy, Elisha Baker, Elisha Townsend and Samuel S. White. George Washington and Lafayette are included among the lay characters who contribute effective background to the various scenes.

Admission will be by badge.

LOCAL ARRANGEMENTS

Chairman: James H. Ferguson, Jr., Baltimore, Md.

Saturday, March 16

9:00 a.m. to 5:00 p.m. Registration *(Mezzanine Floor, Lord Baltimore Hotel)*

Sunday, March 17

9:00 a.m. to 5:00 p.m. Registration *(Mezzanine Floor, Lord Baltimore Hotel)*

2:00 p.m. Trapshooting *(Oriole Gun Club, Gwynn Falls Park)*

Skeet Shoot
Guns all bore. Entrance fee, including 50 targets, $1.50. Prizes: First prize to be known as championship trophy. Three trophies for each class of ten or more shooters. Lewis Class.

Straight Targets
16 yard handicap. Entrance fee, including 50 targets, $1.50.

*Written for the Dental Centenary Celebration by Charles Marquis Warren; produced and directed by Edward Tunis.

Prizes: One prize known as championship trophy. Three trophies for each class of ten or more shooters. Lewis Class. One trophy for high gun—skeet and 16 yard targets. Bring your gun. Guns are also available at the club. (Shells at prevailing club prices.) Medical Men: Prizes for Skeet only. One prize for high gun. One prize for runner-up. Entrance fee, including 50 targets, $1.50.

Fraternities

2:00 p.m. Sigma Epsilon Delta Meeting, Emerson Hotel.

7:00 p.m. Dinner dance for graduate and undergraduate members (formal). Emerson Hotel.

Monday, March 18

9:00 a.m. to 5:00 p.m. Registration *(Main Floor, Fifth Regiment Armory)*

School Speakers

9:00 a.m. Eastern High School (for girls) "America's Contribution to the Building of a Profession," W. N. Hodgkin, Warrenton, Va.

12:30 p.m. McDonogh School (for boys) Lon W. Morrey, Chicago, Ill. Subject to be announced.

2:00 p.m. Catholic High School of Baltimore (for girls) "Diet and the Teeth," Frank P. Duffy, West Warwick, R. I.

2:15 p.m. Seton Catholic High School (for girls) "Dentistry's Contribution to a Happier Life," Daniel F. Lynch, Washington, D. C.

Radio Broadcast—WCAO

"A Century of Progress in American Dentistry," Arthur H. Merritt, New York, N. Y.

Fraternities

12:30 p.m. Alpha Omega Alumni Club of Baltimore. Luncheon for Visiting Fraters, Lord Baltimore Hotel.

12:30 p.m. Psi Omega Luncheon under the auspices of Oriole Alumni Chapter, Emerson Hotel.

5:15 to 6:30 p.m. Xi Psi Phi Stag Reception for national active and alumni members and guests, Lord Baltimore Hotel (Refreshments).

5:00 to 7:00 p.m. Reception, Lord Baltimore Hotel. (For members of the American Dental Association who have registered for the meeting.)

Tuesday, March 19

9:00 a.m. to 5:00 p.m. Registration *(Main Floor, Fifth Regiment Armory)*

School Speakers

8:45 a.m. Roland Park Country School (for girls) "Preventive Dentistry a Phase of Preventive Medicine," L. R. Main, St. Louis, Mo.

9:00 a.m. Patterson Park High School (coeducational) "Some Facts, Fads and Frauds in Dental Health." W. R. Davis, Lansing, Mich.

9:00 a.m. Calvert Hall Catholic High School (for boys) "The Value of a Clean Mouth and Sound Teeth," Albert L. Midgley, Providence, R. I.

9:00 a.m. Frederick Douglass High School for Colored (coeducational) Russell A. Dixon, Washington, D. C. Subject to be announced.

11:00 a.m. Towson High School (coeducational) Subject to be announced.

11:45 a.m. State Teachers College for Women "Good Teeth—Good Health," John Oppie McCall, New York, N. Y.

1:30 p.m. Paul Lawrence Dunbar High School for Colored (coeducational)

10:00 a.m. Fort McHenry, Annapolis and Naval Academy Sightseeing Trip Busses leave Lord Baltimore Hotel, making a brief stop at Fort McHenry en route to Annapolis. The trip will include a visit to the U. S. Naval Academy, Saint John's College, the State House and old St. Anne's Episcopal Church. A visit will be made to several famous homes, all residences of the colonial period occupied in the beginning by men who contributed largely to the destiny of our country. Annapolis is one of the most historical little cities in America. At the close of the Revolution, our treaty with England was ratified in the State House, and it was in Annapolis that Washington surrendered his military commission to Congress. Lunch will be served at Carvel Hall Hotel at 1:00 p.m. Busses will return to Baltimore after

lunch. The price of the round trip sightseeing tour, including lunch, will be $1.25. Purchase tickets when registering or at the information booths in the lobbies of the hotels or at the Armory.

Radio Broadcast—WFBR.

"Growing Perfect Teeth," L. M. Waugh, New York, N. Y.

Civic Club Luncheons

12:15 p.m. Rotary, Lord Baltimore Hotel.
"The Romance of American Dentistry," Arthur H. Merritt, New York, N. Y.

12:30 p.m. Lions, Southern Hotel.
"Your Teeth and Your Future," Charles J. Hollister, Harrisburg, Pa.

5:00 to 7:00 p.m. Reception, Lord Baltimore Hotel (For members of the American Dental Association who have registered for the meeting.)

7:00 p.m. Dinner dance with floor show (informal), Lord Baltimore Hotel. Purchase tickets when registering or at the information booths in the lobbies of the hotels or at the Armory.

Wednesday, March 20

9:00 a.m. to 5:00 p.m. Registration *(Main Floor, Fifth Regiment Armory)*

School Speakers

9:00 a.m. City College High School (for boys)
"Some Aspects of the Problem of Dental Health," Thomas E. Purcell, St. Louis, Mo.

9:00 a.m. Forest Park High School (coeducational)
"The Evaluation of the Human Denture in One's Career," E. L. Valentine, Macon, Ga.

9:00 a.m. Southern High School (coeducational)

9:00 a.m. Western High School (for girls)
"The American Dentist," C. Raymond Wells, New York, N. Y.

10:25 a.m. Polytechnic Institute High School (for boys)
"Our Teeth," John E. Gurley, San Francisco, Calif.

10:00 a.m. Baltimore sightseeing trip and bridge luncheon for women, Baltimore Country Club. Busses leave Lord Baltimore Hotel on a trip to points of unusual interest; such as the site of the first dental college, University of Maryland, Pratt Library, the Baltimore Cathedral (the first Catholic Cathedral to be erected in America), Walters Art Gallery, Peabody Conservatory of Music, Washington Monument (the first in America to be erected in honor of George Washington), Johns Hopkins University, the Art Museum, Chapin A. Harris Monument and other points that will attract the visitor.

Luncheon at Baltimore Country Club at 1:00 p.m., followed by bridge. Valuable door and table prizes will be given.

Tickets, $1.25 each, which will include the sightseeing tour and luncheon.

Purchase tickets when registering, at the information booths in the lobbies of the hotels or at the Armory.

Radio broadcast—WBAL

Scene from historical drama.

12:30 p.m. CIVIC CLUB LUNCHEON, Lord Baltimore Hotel.
"Things in Life Which Count the Most," Walter T. McFall, Nashville, Tenn.

1:00 p.m. Golf tournament
An 18-hole golf tournament will be held at the Roland Park course of the Baltimore Country Club. Valuable prizes will be awarded and refreshments will be served at the clubhouse after the match. Information regarding the golf entertainment can be had at registration headquarters and at all information booths.

ASSOCIATED GROUPS

AMERICAN COLLEGE OF DENTISTS

The American College of Dentists is sponsoring a full day program for March 17 at the Belvedere Hotel, Baltimore. In the evening, a special convocation of the college will be held. The meeting throughout the day is open to the profession.

O. W. Brandhorst, *Secretary*,
4952 Maryland Ave.,
St. Louis, Mo.

NATIONAL ALUMNI ASSOCIATION OF THE BALTIMORE COLLEGE OF DENTAL SURGERY, DENTAL SCHOOL, UNIVERSITY OF MARYLAND

Centenary reunions for all classes are being

arranged by a committee of which B. Sargent Wells is chairman. Alumni should communicate with Dr. Wells, Medical Arts Bldg., Baltimore, for detailed information.

FRATERNITIES

ALPHA OMEGA FRATERNITY

The Alpha Omega Alumni Club of Baltimore will sponsor a luncheon for visiting fraters at the Lord Baltimore Hotel, Monday, March 18.

PSI OMEGA FRATERNITY

The Oriole Alumni Chapter of Psi Omega will sponsor a luncheon at the Emerson Hotel, Monday, March 18.

SIGMA EPSILON DELTA FRATERNITY

The Sigma Epsilon Delta Fraternity will hold its annual convention in Baltimore, March 15, 16, 17, just prior to the Dental Centenary Celebration. Headquarters will be at the Emerson Hotel. All fraters who expect to attend should make their reservations early.

XI PSI PHI FRATERNITY

The Xi Psi Phi Fraternity will hold a reception for active and alumni members at the Lord Baltimore Hotel, Monday, March 18. Refreshments will be served.

COMMERCIAL EXHIBITS

Chairman: HARRY B. MCCARTHY, Baltimore, Md.

Abbott Laboratories, North Chicago, Ill.
Ackerman Dental Mfg. Co., Santa Monica, Calif.
Aderer, Inc., Julius, New York, N. Y.
American Automatic Elec. Co., Baltimore, Md.
American Cabinet Co., The, Two Rivers, Wis.
Anacin Co., Chicago, Ill.
Antidolor Mfg. Co., Inc., New York, N. Y.
Ash, Claudius, Sons & Co., Irvington, N. J.
Austenal Laboratories, Inc., New York, N. Y.

Bakelite Dental Products, Inc., New York, N. Y.
Baker & Co., Inc., Newark, N. J.
Baltimore Dental Laboratory, Baltimore, Md.
Bard Parker Co., Inc., Danbury, Conn.
Bayer Aspirin, New York, N. Y.
Benton Co., Luther B., Baltimore, Md.
Bisodol Co., The, New Haven, Conn.
Bosworth Co., Harry J., Chicago, Ill.
Bristol-Myers Co., New York, N. Y.
Burns Dental Casting Machine Co., Inc., Flushing, N. Y.
Burroughs Wellcome & Co., Inc., New York, N. Y.
Burton Mfg. Co., Chicago, Ill.

Cassel, Roy H., Baltimore, Md.
Caulk Co., L. D., Baltimore, Md.
Caulk Co., L. D., Milford, Del.
Chesapeake and Potomac Telephone Co., Baltimore, Md.
Chicago X-Ray Film & Mount Co., Chicago, Ill.
Clark Cleveland, Inc., Binghamton, N. Y.
Cleveland Dental Mfg. Co., Cleveland, Ohio.
Columbia Dentoform Corp., New York, N. Y.
Columbus Dental Mfg. Co., Columbus, Ohio.
Cooper Dental Laboratory, Baltimore, Md.
Co-Operative Dental Laboratory, Baltimore, Md.
Condit, P. N., Boston, Mass.
Consolidated Car Heating Co., Inc., Albany, N. Y.
Consolidated Gas and Electric Co., Baltimore, Md.
Corega Chemical Co., Cleveland, Ohio.
Corning Rubber Co., Inc., Brooklyn, N. Y.
Cosmos Dental Products, New York, N. Y.
Curvlite Products, Inc., New York, N. Y.

Dee & Co., Thomas J., Chicago, Ill.
Deeley & Son, Charles R., Baltimore, Md.
DeLuxe Dental Laboratory, Baltimore, Md.
Delvale Dairies, Inc., Baltimore, Md.
Dental Specialty Co., Denver, Colo.
Dentists' Supply Co., The, New York, N. Y.
Dudley Research Corp., New York, N. Y.

Eastman Kodak Co., Rochester, N. Y.
Emerson Drug Co., Baltimore, Md.

Fischer & Co., Inc., H. G., Chicago, Ill.
Fleet, C. B., Lynchburg, Va.

General Electric X-Ray Corp., Chicago, Ill.

Hanau Engineering Co., Buffalo, N. Y.
Handler & Son, Edward, Newark, N. J.
Horlick's Malted Milk Corp., Racine, Wis.
Hu-Friedy Mfg. Co., Chicago, Ill.
Hynson, Westcott & Dunning, Baltimore, Md.

Ideal Tooth, Inc., Cambridge, Mass.
Ivory, J. W., Philadelphia, Pa.

Jelenko & Co., Inc., J. F., New York, N. Y.
Johnson & Johnson, New Brunswick, N. J.
Justi & Son, Inc., H. D., Philadelphia, Pa.

Kerr Dental Mfg. Co., Detroit, Mich.
Kolynos Company, The, New Haven, Conn.
Konformax Laboratories, Inc., Brooklyn, N. Y.

Lavoris Company, The, Minneapolis, Minn.
Lea & Febiger, Philadelphia, Pa.

McCormick Rubber Co., E. J., Passaic, N. J.
McKesson Appliance Co., Toledo, Ohio.
Merck and Co., Rahway, N. J.
Mizzy, Inc., New York, N. Y.
Mosby Co., C. V., St. Louis, Mo.

Newberger Dental Laboratory, Baltimore, Md.
Ney Co., The J. M., Hartford, Conn.
Novocol Chemical Mfg. Co., Brooklyn, N. Y.
Noxzema Chemical Co., Baltimore, Md.

Ohio Chemical & Mfg. Co., Cleveland, Ohio.

Pelton & Crane Co., Detroit, Mich.
Philip Morris & Co., Ltd., New York, N. Y.
Picker X-Ray Corp., New York, N. Y.
Poloris Co., Inc., New York, N. Y.
Popper, George, New York, N. Y.
Precious Metals Research Works, New York, N. Y.
Premier Dental Products Co., Philadelphia, Pa.
Puritan Compressed Gas Corp., Kansas City, Mo.
Pycopé, Inc., Jersey City, N. J.

Ransom & Randolph Co., The, Toledo, Ohio.
Read Drug & Chemical Co., Baltimore, Md.
Rice's Bakery, Baltimore, Md.
Ritter Dental Mfg. Co., Rochester, N. Y.
Rooney & Biggs, Inc., Baltimore, Md.
Rothstein Dental Lab., Washington, D. C.
Rubinstein Dental Equipment Co., New York, N. Y.

Saunders Co., W. B., Philadelphia, Pa.
Schaefer, Oskar, Jersey City, N. J.
Seligman & Hite Dental Laboratory, Baltimore, Md.
Sharp & Dohme, Inc., Philadelphia, Pa.
Squibb & Sons, E. R., New York, N. Y.
Stern & Co., Inc., I., New York, N. Y.

Universal Dental Co., Philadelphia, Pa.

Vernon-Benshoff Co., Pittsburgh, Pa.

Wander Co., The, Chicago, Ill.
Weinbaum, I. S., Dental Depot, Baltimore, Md.
Wernet Dental Mfg. Co., Jersey City, N. J.
Western Maryland Dairy, Baltimore, Md.
White Dental Mfg. Co., S. S., Philadelphia, Pa.
Williams Gold Refining Co., Inc., Buffalo, N. Y.
Wyeth & Bro., Inc., John, Philadelphia, Pa.

Yeager, Henry M., Baltimore, Md.
Year Book Publishers, Chicago, Ill.

WELCOME TO THE CENTENNIAL CELEBRATION

In March 1940, Baltimore will open wide its doors to the dental profession. Even in its beginning, this city became famous for the genuine quality of its hospitality. Surrounded by universal bigotry in the New World, Maryland was the first colony to guarantee religious freedom to all who should come to its shores. Baltimore has now become one of the major cities of America, teeming with the commercial life of its vast shipping and industrial enterprises, but still maintaining its early attitude toward the higher things of life, one of which is a wholehearted welcome to the guests within its gates.

The city is justly proud of its record in being the first to establish a number of the most important American institutions, such as the railroad, the telegraph and the first electric trolley car, but it is beginning to realize that, in the long years ahead, the founding of professional dentistry may prove to be of more real and lasting value than any of these. New inventions may displace the steam engine and the telegraph as these did the horse and buggy and the call from hill to hill, but dentistry, a self-perpetuating service designed to promote the well-being and happiness of humanity, will not only continue to live, but will also gain in importance as experience and research shall add to its ability to serve. In Baltimore in 1839 and 1840, Horace H. Hayden, a native of Connecticut, and Chapin A. Harris, a native of New York, led the way with other able men in establishing this great work. Through the centuries before their time, the peoples of the world were hopeless sufferers from the ravages of the most nearly universal of human diseases, dental caries. These men provided the solution to this age-old problem. Today, after only one hundred years, their followers are carrying on in all civilized lands, and everywhere measures are being taken to bring this beneficent service to rich and poor alike.

The centennial of any worthy cause is hailed as a fitting time to celebrate, to evaluate the past and to plan for the future. That time for dentistry is 1940. The profession in Maryland realizes that at no other place would the followers of the immortal Hayden and Harris have the same feeling in celebration as at the site where these pioneers did their great work. For this reason, the Maryland dentists have felt that it is their obligation to make it possible for dentistry at large to return on the one-hundredth anniversary to the birthplace of the profession. Although few in numbers, they have labored for nearly two years in an effort to make this visit pleasant, interesting and profitable to all who may come.

You are welcome.

Dental Centenary Celebration
American Dental Association
Baltimore, Maryland March 18, 19, 20, 1940

HOTEL RESERVATIONS

To secure hotel accommodations for the Dental Centenary Celebration, consult the rate list and fill out the attached blank. Mail this immediately to the hotel of your first choice or to the Centenary Housing Committee, Lord Baltimore Hotel, Baltimore, Md. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed upon, please write or wire the hotel releasing the room, in order that it may be available for other guests.

APPLICATION FOR HOTEL ACCOMMODATIONS

DENTAL CENTENARY CELEBRATION

Baltimore, Md. March 18, 19, 20, 1940

HOTEL.....1st choice

HOTEL.....2nd choice

HOTEL.....3rd choice

Kindly reserve the following: ☐ Single Room ☐ Double Room ☐ Twin Beds.

.....Rooms with bath for.....persons $.....per room

.....Rooms without bath for.....persons $.....per room

Arriving on March.....at.....a.m.....p.m.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL
.....	.....
.....	.....
.....	.....

NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make the reservation requested, this application should be forwarded at once to the Centenary Housing Committee, Lord Baltimore Hotel, Baltimore, Md.

DENTAL CENTENARY CELEBRATION
SCHEDULE OF HOTEL RATES
BALTIMORE, MD., MARCH 18, 19, 20, 1940

Hotels	Single	Double
*ABBEY, 723 St. Paul St.	$1.00 – 2.00	$2.00 – 3.00
ALTAMONT, Eutaw Place & Lanvale Sts.	2.50 – 3.00	3.00 – 4.00
ARUNDEL, Charles St. & Mt. Royal Ave.	2.50 – 3.00	3.00 – 4.00
*BALTIMOREAN, 2905 N. Charles St.	3.00	4.00
BELVEDERE, Charles & Chase Sts.	3.50 – 7.00	5.50 – 9.00
*BILTMORE, Fayette & Paca Sts.	2.00 – 2.50	3.50 – 4.50
*BLACKSTONE (APARTMENT HOTEL), Charles & 33rd Sts.	2.50	4.00
*BRADFORD (APARTMENT HOTEL), 3301 St. Paul St.	3.00	4.00
*CHARLES (APARTMENT HOTEL), 3333 N. Charles St.	3.00	4.00
*COLONNADE, 1337 W. Mt. Royal Ave.	1.00 – 2.00	2.00 – 2.50
CONGRESS, 306 W. Franklin St.	2.50 – 3.00	4.00 – 5.00
EMERSON, Calvert & Baltimore Sts.	3.00 – 6.00	4.50 – 8.00
*FRANKLIN, 410 W. Franklin St.	1.00 – 2.00	2.00 – 2.50
*ALCAZAR (KNIGHTS OF COLUMBUS), Cathedral & Madison Sts.	1.00 – 2.50	3.00 – 5.00
*LATROBE (APARTMENT HOTEL), Charles & Read Sts.	2.50 – 3.00	5.00 – 6.00
*LONGFELLOW, 2 West Madison St.	2.00 – 3.00	3.00 – 6.00
LORD BALTIMORE, Baltimore & Hanover Sts.	3.00 – 6.00	5.00 – 8.00
*MADISON (APARTMENT HOTEL), 817 St. Paul St.	3.00	4.00 – 5.00
*MALLONEE, 111 W. Mulberry St.	1.00 – 1.50	2.50 – 3.00
*MARYLAND, 20 E. Fayette St.	2.00 – 2.50	3.00 – 4.00
*MILNER, Cathedral & Read Sts.	1.00 – 1.50	1.50 – 2.00
*MT. ROYAL, Mt. Royal Ave. & Calvert St.	2.50 – 3.00	3.50 – 5.00
NEW HOWARD, 8 N. Howard St.	2.50 – 3.00	3.50 – 5.00
*ONE HUNDRED AND ONE WEST MONUMENT ST. (APT. HOTEL)	3.00	4.00
*PLAZA, Charles St. & Mt. Royal Ave.	1.00 – 2.00	2.00 – 2.50
*REID, 212 W. Camden St.	1.00 – 1.50	1.50 – 2.00
*SHERWOOD, 212 W. Monument St.	1.25 – 1.50	2.00 – 2.50
*SHIRLEY, 205 W. Madison St.	1.50	2.00
SOUTHERN, Light and Redwood Sts.	3.00 – 5.00	5.00 – 6.50
STAFFORD, Charles & Madison Sts.	3.00 – 4.00	5.50 – 7.00
*TEN HUNDRED AND ONE ST. PAUL ST. (APT. HOTEL)	3.00	4.00 – 6.00
*WALDORF, 1829 N. Charles St.	1.00 – 2.50	2.50 – 3.00
*WESTMINSTER, 418 W. Fayette St.	1.00 – 1.50	2.00 – 2.50
*Y. M. C. A., Cathedral & Franklin Sts.	1.00 – 1.25	1.50 – 2.00

Rates quoted are with and without bath.
*Hotels with less than 100 rooms.
The Centennial Committee on Hotels advises making reservations early.

CURRENT LITERATURE

Effects of Neoarsphenamine and Sulpharsphenamine on Experimental Fusospirochetal Infection in Guinea Pigs

By Theodor Rosebury, Genevieve Foley and F. Rights

Neo-arsphenamine and sulfarsphenamine were used in the therapy of fusospirochetal lesions produced experimentally in guinea-pigs. The animals were inoculated subcutaneously with exudate derived originally from human lesions and passed successively through guinea-pigs. Introduction of either drug into the infectious area reduced the fusospirochetal flora, and decreased or abolished the infectivity of the exudate for other guinea-pigs. Neoarsphenamine seemed to be more effective than sulfarsphenamine. There was no beneficial effect when either drug was injected systemically.

The results seem to indicate that these drugs may be used in the treatment of accessible fusospirochetal infections in man.—*J. Infect. Dis.*, 65:291, 1939.

Hazel Tefft.

Factors in the Control of Dental Caries of Children

By J. Boyd

A statistical study of repeated dental examinations of more than 250 children during ten years serves as a basis for this report. One hundred and seventy-five of these children were under management for diabetes mellitus. Twenty-one were normal, serving as subjects for prolonged metabolic studies. The remainder were under treatment for latent hereditary syphilis. In all, apparent health was the rule. The first two groups received prescribed diets; the remainder were under no dietary supervision.

Of the first group, only three children failed to attain control of caries. As to the remainder of the diabetic children, an average of four years elapsed before further evidences of caries appeared. In 40 per cent, there was no evidence of reactivation. In all but seven of those showing reactivation, the condition remained at minimal levels. The exceptions are explainable on the basis of non-cooperation in the prescribed regimen. Of the normal children, caries was controlled in all but three. These children designedly received diets with a suboptimal content of specific nutritional essentials. Comparison of the rate of appearance of new cavities in the children under dietary control with that observed in the uncontrolled group revealed that residual caries diminished in the former group in the course of several years, whereas it increased in the latter. Statistical analysis of the data shows these differences to be significant.

Various types and combinations of diets were found to be effective in arresting caries. All were similar, however, in their high content of protective factors. Mouth hygiene was poor in the majority of cases. It offered no correlation with the condition of the teeth. It is concluded that intrinsic factors play a preponderant rôle in the protection of the teeth from decay and that diets rich in protective factors are desired. —*Am. J. Dis. Child.*, 58:920, October 1939.

Virgil D. Cheyne.

Dental Health Organizations in State Departments of Health in the United States

By F. C. Cady

This report summarizes the change in dental health organizations in state health departments in the last five years. The report includes (1) a description of the activities of the United States Public Health Service in the field of public dental health, (2) a short history of state public dental health service in the United States, (3) methods of selection of dental personnel in the various state health departments, (4) relationships of the state health department with district and local health units and (5) the amount of federal funds allocated to states for dental purposes. States that do not have dental units in the state departments of health are not covered in this report. They include Arizona, Colorado, Idaho, Louisiana, Mon-

tana, New Hampshire, New Jersey, New Mexico, North Dakota, South Dakota, West Virginia and Wyoming.—*Pub. Health Bull.*, No. 251.

J. VOLKER.

Studies on Lactobacilli. II. Type-Specific Immunological Reactions of Oral Strains

By R. HARRISON, Z. ZIDEK and E. HAMMENS

BY means of precipitation reactions between antibacterial serum and bacterial carbohydrate, four distinct types and a group of heterogeneous strains of oral lactobacilli have been found. The previously determined morphologic and fermentative groups (*J. Infect. Dis.*, 65:142, 1939) did not conform to the immunologic groups, but there was a high degree of correlation. Extension of these immunologic studies may make possible the determination of the types of lactobacilli most commonly found in the mouth and in apparent association with dental caries.—*J. Infect. Dis.*, 65:255, 1939.

HAZEL TEFFT.

Epanutin and the Gums

EARLY this year Kimball observed hyperplasia of the gums as a complication during the treatment of epilepsy with sodium diphenyl hydantoinate (epanutin). He noted that, though its severity seemed to vary inversely with the amount of ascorbic acid in the blood, the administration of ascorbic acid or of a diet rich in vitamin C did not reduce its incidence. In recording a series of seventy-five chronic cases treated in mental hospitals, Blair and his colleagues say that the hospital dentist could find sponginess of the gums in only two cases in which it could in any way be attributed to the epanutin given. Steel and Smith noted painful and tender gums in some of their patients, but Williams found no such complication in ninety-one epileptics treated with epanutin. Hyperplasia of the gums was observed by McCartan and Carson in one case out of nineteen. Frost gave some of his patients a preliminary course of vitamin C and did not report any lesion of the gums; but he drew attention to a new toxic manifestation, epistaxis associated with a raised blood-pressure, in two patients who had received a course of vitamin C. Pratt had all his patients examined by the dentist, especially for hyperplasia of the gums, with the result that a mild degree of it was found in nearly half of them. Thereupon, a similar examination was made of fifty-two other patients in the same cottages and wards who were on other treatment, and the dentist's findings were almost the same.—Notes, Comments and Abstracts.—*Lancet*, 2:1105, November 18, 1939.

B. P. KEARNEY.

Beitrage zur Seralogischen Differenzierung Anaerober Leptotricheen (Contributions to Serologic Differentiation of Anaerobic Leptotrichia)

By RAZI MANER

RABBITS were given intravenous injections of strains of anaerobic Leptotrichia in pure cultures. The serum obtained from them agglutinated to a titer of 1/320, not only the homologous strains, but also other strains of Leptotriceni and Leptotrichia-like organisms. The strains of spirilla used as controls were not agglutinated. Three strains of Leptotrichia were agglutinated in a low titer, 1/40, to the serum of the men from whom they were isolated. Extension of the work will further the identification of Leptotrichia strains and will contribute to the establishment of their pathogenicity in the human body.—*Zent f. Bakt.* I Orig., 144:439, 1939.

HAZEL TEFFT.

Plasmocytome de la langue (Plasmocytoma of the Tongue)

By G. MILIAN

IN plasmocytoma of the tongue in a man aged 58, the initial symptoms were prickling sensations followed by increasing pain, which later became incapacitating. There was extreme general fatigue and a loss of 20 kg. in weight.

The patient was first seen six months after onset of the symptoms. The tongue was garnet red and tripled in size, with most of the enlargement on the right side. There were irregular ulcerations on the right side, with many yellow nodules the size of a pinhead. The left border was indurated and, on the superior surface in this region, there was a rounded sessile elevation the size of a franc. There were three small papular, ulcerated lesions on the mucosa of the left cheek near the angle of the mouth and there was a

bilateral submaxillary lymphadenopathy in which the nodes were hard, mobile and not tender. No tubercle bacilli were found. The patient gave no history and had no clinical signs of syphilis, and the serologic test was repeatedly negative. In the initial blood count, there were 34,600 leukocytes, with 87 per cent polymorphonuclears, 7 per cent monocytes, 4 per cent lymphocytes and 2 per cent plasmocytes.

In spite of the lack of syphilitic findings, the lesion so closely resembled a gumma that a course of antisyphilitic therapy was tried. As there was no improvement, x-ray therapy was employed. With this, the pain decreased, the tongue became less violaceous, the submaxillary glands decreased in size and the patient was able to eat.

Several months later, the patient died of a spreading erysipeloid infection of the head and neck. At necropsy, the tumor was found in the local region, including tongue and cheek, and in one small implant in one kidney. Sections of the tongue lesion showed that it consisted almost entirely of plasmocytes growing in a connective-tissue stroma. The tumor cells had replaced the subcutaneous layer, in many areas being covered by a thin layer of epithelium. In their downward invasion, they separated the muscle fasciculi. The plasmocytes had typically round nuclei with eccentric granules and ovoid or trapezoid cytoplasm. There were sometimes two nuclei which were equally eccentric, or even three, in which case they occupied the periphery of a more voluminous cell. Several rare cells with four hypertrophied nuclei were seen, the nuclei being tripled in size and the cell correspondingly enlarged. The implants in the pericarotid nodes appeared much the same, except that the connective-tissue reticulum was much more marked and in places appeared alone. Around the periphery, there were a few cells of the reticulum in which the nuclei had multiplied and hypertrophied, and somewhat resembled the cells of Sternberg. In a few areas, there had been mass necrosis of the tumor cells, which gave an appearance suggesting caseation, but, in one area, a true fibrocaseous tubercle was clearly demarcated from the necrotic tumor material. The author notes that plasmocytoma is not a frequent tumor and is usually observed in the bones.—*Bull. et mém. Soc. méd. d. hôp. de Paris,* 55:908, 1939; abstr. *Surg. Gynec & Obst.,* 69:540, 1939.

VIRGIL D. CHEYNE.

The Rôle of Anaerobic Bacteria in Noma. Clinical and Experimental Observations

By A. HELLER and T. MEDNEDEVA

THE authors treated fourteen cases of noma or gangrenous stomatitis by excision of the necrotic tissues followed by an application of iodine and potassium permanganate solutions. The oral cavity and the defect resulting from the operation were irrigated two or three times daily with a warm potassium permanganate solution, and a high caloric diet was prescribed. In none of the fourteen cases did the authors succeed in arresting the progress of the condition, and all fourteen children succumbed to noma.

In fifty-three other cases, this treatment was supplemented by the administration of an antiperfringens serum. Under the influence of the injections, the edema diminished, the pathologic infiltration of the tissues disappeared within four or five days and cicatrization followed. In cases with extensive necrosis, a cessation of the process was obtained and gradually healthy granulations appeared. Moreover, the general condition of the children improved and apathy was replaced by considerable activity and an improvement in appetite. In fifteen cases, blood cultures were made, in five of which *Bacillus perfringens* was isolated. The eleven remaining cultures were sterile.

The authors conclude that the presence of perfringens bacilli in noma is not accidental and that it aggravates the condition considerably and, in many instances, is responsible for the spreading of the necrosis and toxemia. The use of a specific antiperfringens serum is logical because clinical and laboratory observations show its efficiency and point to the presence of toxemia in noma. Fusospirochetosis accompanying noma should be considered as a secondary infection which contributes to the seriousness of the condition. The proper treatment of noma consists of a combination of surgical procedures, especially excision of the necrotic tissue, with employment of antiperfringens serum.—*Vestnik khir.,* 57:409, 1939; abstr. *Surg. Gynec. & Obst.,* 69:608, 1939.

VIRGIL D. CHEYNE.

Carcinoma of the Parotid Gland in Youth

By T. Case

The occurrence of carcinoma of the parotid in children is quite rare. A survey of the literature disclosed only one other case and that one of doubtful origin. The case reported concerns the discovery of a primary epidermoid carcinoma of the parotid gland in a girl 11 years old. The condition was not recognized until the pathologist had examined the excised tumor mass. The surgical procedures were supplemented by roentgenotherapy. No recurrence of the tumor mass has been observed.—*Ann. Surg.*, 111:155, January 1940.

J. Volker.

Bacterial Dissimilation of Carbohydrates

By C. H. Werkman

This review analyzes, in line with modern findings, the biochemical events concerned in bacterial fermentation of carbohydrates, and discusses the enzyme and coenzyme systems taking part in the process. The Embden-Myerhof scheme of fermentation in which breakdown occurs by way of phosphorogylceric acid is accepted as valid for bacteria, but the possibility of alternative routes of carbohydrate dissimilation by bacteria is noted.—*Bact. Rev.*, 3:187, 1939.

B. G. Bibby.

Vincent's Infection

By W. Rose

Vincent's infection is an acute inflammatory disease of the oral cavity affecting mainly the gingival borders and interdental papillae, although it may occur elsewhere in the mouth. It is extremely infectious and gives rise to general as well as local symptoms. It may be chronic as well as acute. Some of the predisposing causes are faulty diet, lack of oral hygiene, chronic smoking, traumatic occlusion and general disease such as diabetes, toxemia, metallic poisoning, syphilis and blood dyscrasia.

The infection is caused by *Fusiformis dentium* and *Treponema vincenti*. Vincent's organisms, being anaerobes, must be recovered from the deeper tissues. They may be stained with Sterling's gentian violet, carbolfuchsin and methylene blue or crystal violet. Diagnosis can be made usually by the local and general symptoms, but, in doubtful cases, smears should be made.

Treatment consists of improving the hygiene of the mouth, spraying the mouth with warm 1.5 per cent solution of hydrogen peroxide and applying a 3 to 5 per cent solution of chromic acid to the tissues. This may be alternated with 3 to 10 per cent neoarsphenamine in glycerin applied locally or mapharsen used as a dry pack or dissolved in water and applied to the tissues. General supportive care should be instituted. The infectious nature of the disease should always be kept in mind.—*Mil. Surgeon*, 86:26, January 1940.

S. B. Finn.

Thumb and Finger Sucking in Childhood

By W. S. Langford

Thumb and finger sucking in the young child are of importance because of the concern that they cause parents. Sucking of the thumb or the fingers occurs at some time in nearly every child's life and the pediatrician to whom the alarmed parents come for advice is often as confused about the significance of this practice as are the parents themselves. The author writes this report in an effort to minimize the fears and anxiety caused both to parents and to the pediatrician. Causes of the condition are discussed in detail. Hunger, boredom, fatigue, illness, frustration, deprivation and punishment all cause the habit to be a solace to the child. Treatment should be largely limited to ameliorating the more obvious sources of emotional dissatisfaction in the child. Restraints are mentioned as being contraindicated in the younger age groups. The author (physician) mentions in conclusion that deformity of the mouth is characteristic, but will usually disappear spontaneously if the sucking stops before the eruption of the permanent teeth. —*Am. J. Dis. Child.*, 58:1290, 1939.

Virgil D. Cheyne.

Effects of Selective Salivary Gland Extirpation upon Experimental Dental Caries in the Rat

By V. D. Cheyne

The use of the rat as an authentic method of studying dental caries is rapidly gaining favor in biologic research work. Workers in other fields have studied changes in caries susceptibility in this animal as occasioned by the use of different diets.

In the present article, the author has standardized the extent of caries produced on two diets, a non-caries-producing stock diet and a caries-producing ground corn diet. In test animals subjected to varying combinations of gland removal, the resulting incidence of caries susceptibility was compared.

A total of eighty-eight rats were selected from the same Wistar breeding stock at 22 days of age and placed upon the two different diets. Groups of rats in each series were operated upon to remove the various salivary fractions. After 100 days on the diet, the animals were chloroformed and all molar teeth examined under a binocular microscope as well as in histologic ground and decalcified sections.

The significant findings are that animals with totally removed serous saliva show a high incidence of caries involvement, the increase being in direct proportion to the amount of serous saliva removed. The effect of elimination of the normal salivary flow is most marked in rats with retained mucous saliva on the caries-producing diet, although it was also found to be high in a similar group on the stock diet, which was known to be normally productive of very little caries. It is concluded that disturbance of normal salivary flow by any combination of removal results in an increased incidence of experimental dental caries. The lower ratio of fracture to carious lesions in rats with retained mucous saliva would indicate that the rate of development of lesions in these groups is very rapid.—*Proc. Soc. Exper. Biol. & Med.*, 42:587, 1939.

B. P. KEARNEY.

Observations on 1,136 Cases of Enlarged Tonsils and Adenoids

By C. ROLLESTON

THIS study has been based on observations made by the author during twenty-five years on 1,136 cases of enlarged tonsils and adenoids. Enlarged tonsils were found to be more common in boys than in girls. Inherited disposition seemed to be a factor in the development of enlarged tonsils and adenoids, while "the method of upbringing" during infancy did not appear to have any bearing on these conditions.

The author found a positive correlation between enlargement of the tonsils and dental caries, goiter, enlargement of the cervical glands, deafness and "considerable retardation in education." No correlation was found between rheumatism and enlargement of the tonsils or adenoids. Removal of enlarged tonsils and adenoids the author considers as one of the most successful of all operations.—*Brit. J. Child Dis.*, 36:250 (October-December) 1939.

R. F. SOGNNAES.

Treatment of Leukoplakia Buccalis and Related Lesions with Estrogenic Hormone

By I. T. NATHANSON and D. B. WEISBERGER

THE authors present evidence that buccal leukoplakia is associated with alterations in the menstrual cycle in women and with a deficiency or disturbed metabolism of the sex hormones in both sexes. Treatment with estrogen resulted in complete cures in 42 per cent, marked improvement in 39 per cent and no improvement in the remaining 19 per cent of thirty-eight patients.

It was observed that women responded more satisfactorily than men to the treatment.—*New England J. Med.*, 221:556, October 12, 1939.

B. P. KEARNEY.

Aerobes Wachstirm von Anaeroben Zahnbakterien (Aerobic Growth of Anaerobic Dental Bacteria)

By A. ILLENYI

THE anaerobic mouth organisms *Leptothrix tenuis* and *B. fusiformis* were used in tests for aerobic growth. Tests were carried out in liver broth with vitamin C, ascitic broth with vitamin C, liver broth with filtrate from a culture of *Bacillus prodigiosus* and broth with glycogen. *Leptothrix tenuis* grew under aerobic conditions in liver broth with vitamin C, ascitic broth with vitamin C, liver broth with prodigiosus filtrate and broth with glycogen. *B. fusiformis* grew aerobically in ascitic broth with vitamin C, ascitic broth with prodgiosus filtrate and liver broth with the filtrate. —*Zent. Bakt.*, I Orig., 44:502, 1939.

HAZEL TEFFT.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Time Saver in Correcting Bite—Black carding-wax strips upon which diatoric artificial teeth are mounted are time-savers in taking a corrected bite when dentures are to be ground outside the mouth.—*G. Sidney Jacks, 4125 W. Montrose Ave., Chicago, Ill.*

Suture in Hemorrhage—In postextraction hemorrhage, the buccal and lingual tissues should be sutured as this procedure is far more effective than the use of pressure packs and consumes only a fraction of the usual time. It also eliminates the possibility of recurrence of hemorrhage from removal of the gauze packing at a later date.—*Dorsey R. Tipton, Baltimore, Md.*

Aid in Deflasking Partial Plates When Acrylic Resins Are Used—When the boiling method of processing the acrylic resins is used, the plaster does not disintegrate or "break down"; hence, the recovery of a partial denture is sometimes difficult and tedious, and there is a possibility of distorting the bar and clasps. Molding modeling clay around the bar and clasps before flasking the case facilitates the deflasking.—*F. D. Steckman, Albany, Ind.*

Pouring Lower Full Denture Impressions—In the new lower denture impression technics, the rounded peripheral borders must be preserved and should not be mutilated by boxing the impression. Hence, the stone cast must be made by vibrating the stone into the impression held in the hand and then turned over on the laboratory bench to form a flat base. Ordinary wall paper cleaner molded into the tongue space of the impression forms a "stop" for the stone and the floor of the cast is thus formed.—*F. D. Steckman, Albany, Ind.*

Technic for Constructing Vulcanite Impression Trays, Emergency Partial Dentures and Removable Orthodontic Vulcanite Appliances—For rapidly constructing vulcanite trays, the impression is poured with a fast-setting stone and half-flask in proper position in the bottom of a vulcanite flask. When the stone has set, the impression material is removed. The cast surface is dehydrated with alcohol and acetone evaporated with a chip blower. The cast is moistened with carbon tetrachloride, immediately painted with liquid tire patching cement and dried for several minutes with compressed air. The palate or, if a lower cast, the lingual portion is covered with a piece of vulcanizing rubber to the crest of the ridge. To the labial aspect, a strip of this rubber is added to overlap the crest of the ridge and the lingual piece and is adapted to the cast with finger pressure. This overlap thus creates a double thickness of vulcanite that acts in reenforcement. Smaller strips of vulcanite can be added at the periphery or wherever more is desired for strength or bulk. These are pressed to place and

smoothed with a warm spatula. Tray handles can be added by the adhesion of properly conformed vulcanite rubber, painted with waterglass and dried. The case is then full flasked and vulcanized.

Emergency partial dentures can be similarly constructed by holding the teeth in relation and packing vulcanite around them. This is especially true of anterior teeth that were lost through accident or where a permanent restoration cannot be made at once. Usually, not more than three teeth approximating one another can thus be added with a margin of security of position in the elastic rubber. Finishing is done as before mentioned and the case is vulcanized.

Orthodontic retainers can also be constructed even to the addition of wire extensions held securely in position with dental cement against the teeth where vulcanite is not to be packed. The rubber is packed against the wire extension tail, which should be looped for security, and finished as the vulcanite tray is.—*F. J. Svoboda, Cozad, Nebr.*

Nature's Articulator — The normal human jaw is undoubtedly the best articulator we have, and the centric position is invariably correct.

Chrome-Plating Aluminum Objects in the Dental Office—Generally speaking, metallic aluminum cannot be chrome-plated satisfactorily by the technic employed for plating steel, copper, etc.; but extremely satisfactory results can be obtained if the following technic is employed: A bath of dilute oxalic acid is constructed into which the aluminum electrodes or objects are introduced. These objects are connected to the terminals of a switching arrangement affixed to a 50-volt step-down transformer. Current in quick steps of 5, 10, 15, 20 and 25 volts is applied in rapid succession alternately for a ten-minute period followed by a "shock" action employing the full 50 volts on the electrodes. The poles are reversed during the last five minutes. The electrodes are then immersed in hot potassium cyanide or hydrofluoric acid solution very briefly until a tiny bubble appears on the surface of the solution. The objects are washed thoroughly in water, nickel-plated and buffed very carefully and well, and then finally chrome-plated and polished. The plating will not peel off and a lasting chromium finish will adhere to the aluminum.—*G. Sidney Jacks, 4125 W. Montrose Ave., Chicago, Ill.*

CORRESPONDENCE

"OCCUPATIONAL DERMATITIS IN DENTISTRY"

An article in the September Journal by A. H. Robertson concerning occupational dermatitis prompts me to say a word about my own experience. For many years, I was greatly troubled with dermatitis owing to the use of local anesthetics, of which I tried almost every kind on the market. Three years ago, I stopped using procaine with epinephrine. I now use it with neosynephrine. As soon as I made the change, the dermatitis subsided and soon disappeared completely; which seems to indicate that the epinephrine caused the trouble, not the procaine. Procaine with neosynephrine is on the market in cartridge form and is easily available. I hope this answers someone's question as to what to do in these troublesome cases. It may not work successfully with everyone, but it certainly solved the problem for me, and a very serious problem. Persons not thus affected do not realize how serious this condition can be.

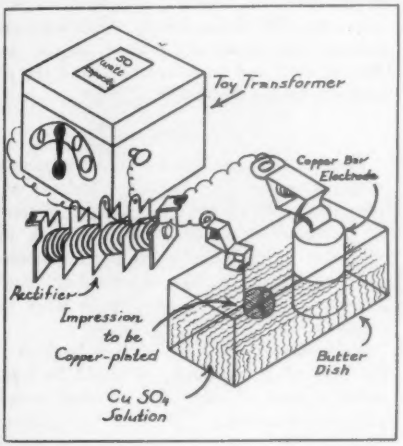
J. H. Dickey,
Millikin Building,
Decatur, Ill.

INCIDENTS OF PRACTICE

The Construction of a Simple, Yet Efficient Copper-Plater

By Bernard D. Lynn, D.D.S., Detroit, Mich.

The desirability of a copper-plated die for inlay work by the indirect method is readily admitted by all practitioners. However, owing to present economic conditions, many dentists hesitate to invest in an expensive commercial machine which will



copperplate impressions. Uniformly good results have been obtained with a device of my own construction. The materials employed are:

1 toy-train transformer (50 Watt capacity).
1 rectifier (25 junction magnesium cupric sulfide rectifier that will handle 25 Watts D.C.).
1 glass butter dish (2½ by 3 by 5 inches).
1 bar solid copper (1 inch diameter).
2 battery clamps.
4 feet No. 18 wire (insulated bell wire).

The transformer cuts down the voltage from the 110 volts of the electric light circuit to 6-15 volts. The rectifier converts the A.C. to D.C. and thus the steady stream of copper particles can be smoothly deposited on the metallized surface of the impression.

The rectifier is hooked to the transformer as shown in the diagram. The voltage control is adjusted by trial and error to give the most efficient results (about 6 volts). Now, one of the clamps is connected to the copper bar electrode and attached to the rectifier exactly as shown in the diagram. The other clamp is hooked to its terminal on the rectifier and attached to the impression. With this hook-up, the impression can be copper-plated in about eight hours.

2201 South Fort Street.

An Inverted Third Molar

By Joel Margaretten, D.D.S., Los Angeles, Calif.

A woman, aged 52, complained of a sore spot under a full upper denture in the tuberosity region. Since there seemed to be a muscle impingement, the denture was trimmed. As it became necessary to repeat the pro-

cedure, a roentgenogram was made of the area, and an inverted third molar was revealed, the root apex piercing the gum and the crown buried in the maxilla. Extraction was simple and recovery was uneventful.

Multiple Impactions

By William Levitien, D.D.S., and Edward Goldstein, D.D.S., Brooklyn, N. Y.

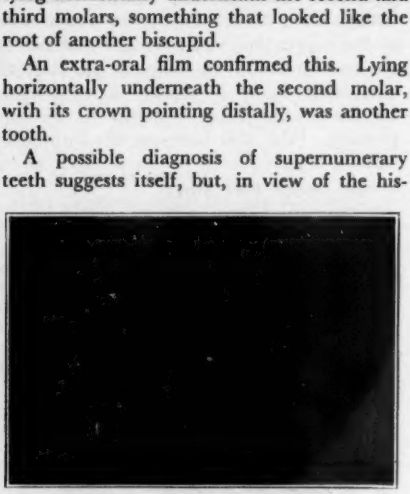
A woman, aged 52, of Italian descent, had the lower left first and second bicuspids missing, the first molar badly broken down, the second molar in place and the third molar missing. The patient said she had never

had any teeth in the left bicuspid area extracted, to her knowledge, but had been told by her mother that at the age of 10 she had had scarlet fever and has lost many teeth on that side.

The intra-oral film of that area showed a badly broken down first molar; a horizontal impacted third molar; a horizontally impacted bicuspid, lying anteriorly to the first molar with the crown pointed distally, and, lying horizontally underneath the second and third molars, something that looked like the root of another biscupid.

An extra-oral film confirmed this. Lying horizontally underneath the second molar, with its crown pointing distally, was another tooth.

A possible diagnosis of supernumerary teeth suggests itself, but, in view of the history of an absence of teeth in the bicuspid area, it can be safely said that the impacted teeth in question are the first and second bicuspids and the third molar.



Because of poor general health and in the absence of any symptoms referable to the impacted teeth, the only treatment outlined at present is the removal of the broken down first molar.

1477 Forty-Third Street.

Use of Sulfanilamide and Guaiacol Glycerine Solution

By R. J. De Wolf, D.D.S., Harvard, Ill.

This is a report of the postoperative procedure in one hundred extraction cases. In fifty cases, sulfanilamide (2 grains) were triturated and mixed with distilled water to form a pastelike mass. The socket was then partially swabbed to remove the blood; the paste was inserted in the socket after removal of the tooth, and a cotton pledget was moistened with a 10 per cent solution of guaiacol in glycerine and was inserted in the socket in a position to overlay the paste containing sulfanilamide.

Fifty cases of extraction were used as a control. The procedure in these cases consisted of merely removing the teeth and having the patient bite down on some cotton which was placed over the open socket. This was followed in two hours by rinsing the mouth with a warm salt solution.

In the fifty cases treated with sulfanilamide and guaiacol and glycerine, four developed dry socket. Soreness and pain was relieved and the treatment repeated in twenty-four hours. Healthy granulation tissue was observed to have begun to develop in the following twenty-four hours.

In the fifty cases which were untreated eighteen developed dry socket, and it was between two and three weeks before the patient was relieved of pain.

CONCLUSION

That the use of sulfanilamide with guaiacol in glycerine has such amazing results is very interesting. From my observations, guaiacol in glycerine alone does not approach the efficiency it has when used in combination with sulfanilamide, nor does sulfanilamide alone prove nearly so efficient as when the combination is used.

Since dry sockets are such a bugbear to the general practitioner, it would be interesting to hear of the results of other men in using this treatment.

Extraction of Impacted Bicuspid, with Improvement in Eyesight

By Precioso B. Villareal, Surigao, Surigao, Philippines.

A boy, aged 14 years, reported to the clinic for a simple cavity filling October 8, 1938. He had stopped school in September 1938 and was on his way to the capital to consult a specialist regarding his eyes. He complained that he could not see at times, even in the daytime, and could not recognize any object at night. The history indicated that the condition was hereditary since, in the family of eight children, only one, a girl, had perfect eyesight.

Examination disclosed that the lower right second bicuspid was impacted. The

first molar grew over it. The father decided to postpone the trip to the capital for one week, and the following day the molar together with the bicuspid was removed. That evening, the patient insisted on going alone to report to the clinic without the usual guide because he was able to see. He was dismissed as cured in a week. On the insistence of his father, the boy did not return to school until June. He reported to the clinic in July 1939 that his eyesight had not given him any further trouble.

Roentgenography and Surgery

By Matthew Lozier, B.S., D.D.S., New York, N. Y.

Correlation in diagnosis of a condition established first by clinical and roentgenographic means and then corroborated

Cystic area.

by surgical procedure is an everyday occurrence.

Because roentgenography, when correctly practiced, is an exact science, any finding during surgical interference contrary to the preestablished roentgenographic evidence should be most carefully considered as regards the possible cause of the apparent contradiction.

REPORT OF A CASE

A general roentgenographic examination disclosed a small radicular cyst attached to the apex of the lower left lateral incisor, as seen on the accompanying roentgenogram. The condition itself was chronic and entirely painless. After the tooth had been removed and the apical area exposed well to view, the periapical bone, upon careful examination, was found to be solid and apparently healthy, though neither the apical root portion nor the area in which it was located gave evidence of cystic tissue.

Only the unmistakable evidence of the cystic area in the roentgenogram and the conviction that a properly taken roentgenogram does not lie prompted further exploration and probing of the apparently sound periapical bone. When this probing proved fruitless, a small round sharp curet was employed to scoop out a goodly portion of solid bone, and only then was the cystic area disclosed.

Throughout the entire procedure, there was no visible communication between the periapical bone and the cystic area below it.

The lesson to be learned here is twofold:

1. Never proceed with any surgical procedure, however slight apparently, without a well-made roentgenogram.

2. The roentgenographic findings should at all times be corroborated by the surgical findings, and anything less than that must be looked at askance.

369 East One Hundred and Forty-Ninth Street.

Impacted Upper Fourth Molar

By Samuel Friedman, D.D.S., Bronx, N. Y.

A man, aged 25, complained of pain in the upper left molar region. Clinical examination revealed an upper partially erupted

third molar. Merely the tips of the buccal cusps had penetrated the mucous membrane. The mesiobuccal cusp, however, was badly decayed, and pulp exposure seemed certain. X-ray examination revealed a fully formed fourth molar lying almost at right angles to the third molar, as shown in the illustration. A flap was made and overlying bone re-

moved, and the third molar finally yielded to the forceps, but with great difficulty. Upon inspection, this tooth showed but two roots, both buccal. The apices were thickened and extremely curved, winding around almost in a semicircle toward the lingual aspect. The fourth molar was then elevated with ease through the open socket. This tooth had a single root and resembled an upper bicuspid.

1011 Freeman Street.

Impacted Incisor and Dentigerous Cyst

By W. H. Gilbert, D.D.S., Austin, Texas.

History.—A white girl, a high school student, with no local manifestation of pain or discomfort and of good general condition, and who had had the usual diseases of childhood, with no illness of a serious nature, was reported by her mother as subject to intervals of extreme emotionalism, bordering at times on spasm. This statement was believed to be exaggerated. There is no family record of malignancy.

Fig. 1

Examination.—A clinical examination of the teeth and mucous membranes was negative except for the upper left central incisor, which was unerupted. X-ray examination revealed the impacted incisor lying parallel to the median line of the palate with its incisal edge about 1 inch back from the labial plate. There was no nasal or palatal bulge. The area between the crown of the impacted tooth and the labial plate was occupied by a dentigerous cyst, clinically evident as a slight labial bulge. The presence of the cyst probably accounts for the space between the left lateral and the right central incisor.

Operation.—A labial flap was reflected and the labial plate removed laterally to points near the roots of the adjacent teeth, just below the nasal spine above and to the alveolar crest below. The cyst was composed of a dry mass of small teeth fused together and two small teeth attached to the mass proper by a fibrous membrane. The impacted tooth distally from the mass and in horizontal position was of normal development. The entire procedure was carried out with local anesthesia.

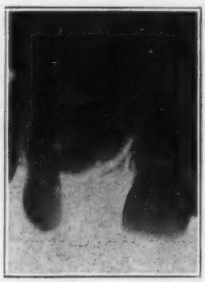


Fig. 2

Fig. 3

Outcome.—Healing was uneventful.

413 Norwood Building.

Functional and Esthetic Value of a Space-Maintaining Appliance

By Waldemar A. Link, A.B., D.D.S., Chicago, Ill.

History.—A child, aged 3½ years, lost four upper anterior deciduous teeth as the result of an injury incurred in jumping from a porch to the ground; the force of the impact being such that both the upper right first and second deciduous incisors were completely dislodged from the alveoli, the upper left central deciduous incisor was fractured at the gingival margin and the left deciduous lateral incisor was driven into the maxilla so far that it almost touched the crown of the respective permanent incisor.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Treatment.—The patient was hospitalized and the remaining two deciduous incisors were extracted under a general anesthetic. The appliance shown in Figure 2 was constructed and cemented to place. For purposes of stability, it became necessary to substitute crowns for bands, since the deciduous molars and cuspids were too short. The result has been pleasing since the appliance is an aid in speech and in mastication, maintaining proper lip form and has kept the patient from developing an inferiority complex.

4051 West North Avenue.

Susceptibility to Colds Cured by Sinus Drainage After Extraction of Molar

By Precioso B. Villareal, Surigao, Surigao, Philippines.

A Chinese mestizo, aged 28, reported to the clinic March 13, 1939, complaining of simple toothache of the upper right first molar. Extraction was successful. Eight days afterward, the patient came back complaining of severe pain on the region where the molar was extracted. He had high fever for three nights and could not go to sleep. The wound was healing without any evidence of infection. Further examination disclosed that the patient had acute sinusitis. There was a history of repeated colds. It was decided to open the sinus through the opening of the extracted molar. Pus with a very foul odor was removed. The sinus was drained with the aid of water syringe. One and a half weeks later the patient was dismissed as cured.

July 7, 1939, the patient reported the success of the operation and stated that colds no longer troubled him.

Injury to Deciduous Teeth

By Reuben Sharenson, D.D.S., Brookline, Mass.

January 23, 1939, a boy, aged 23 months, was brought in with an injury to his upper lip and teeth incurred during a fall while nursing from a bottle. Examination showed that although the upper central incisors were intact, the lateral incisors have entirely disappeared from view. It seems that the rim of the bottle has hit the lateral incisors, while the central escaped injury by fitting into the lumen of the bottle.

An intra-oral film (Fig. 1) showed that the lateral incisors were present but submerged.

Removal in order to avoid abscess formation was first considered, as it seemed certain that the peridental membranes had been destroyed; but, after some deliberation, it seemed advisable to wait. The mother was instructed to use cold applications on upper lip and was advised to report further swelling or discomfort.

Fig. 1.

Fig. 2.

October 10, 1939, the child was seen again. Both lateral incisors had grown to full height. The gums and the color of the teeth looked normal, except that the left lateral incisor was slightly deflected palatally, biting inside the lower teeth. It is impossible to say whether the permanent teeth were in any way disturbed.

Another x-ray film was taken. (Fig. 2.)

This case demonstrates the regenerative powers of injured tissue in the young.

516 Harvard Street.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

AMERICAN ASSOCIATION OF DENTAL SCHOOLS, Philadelphia, March 15-17.

AMERICAN ASSOCIATION OF ORTHODONTISTS, Chicago, Ill., May 13-16.

AMERICAN COLLEGE OF DENTISTS, Baltimore, March 17.

AMERICAN DENTAL ASSISTANTS ASSOCIATION, Cleveland, Ohio, September 9-12.

AMERICAN DENTAL ASSOCIATION, Cleveland, Ohio, September 9-13.

AMERICAN PUBLIC HEALTH ASSOCIATION, Detroit, Mich., October 8-11.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY, New York, N. Y., March 25.

CHICAGO DENTAL SOCIETY MIDWINTER MEETING, February 12-15.

CLEVELAND DENTAL SOCIETY, April 8-9.

DENTAL CENTENARY, Baltimore, Md., March 18-20.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

FIVE STATE POST GRADUATE CLINIC, Washington, D. C., May 19-23.

GREATER PHILADELPHIA ANNUAL MEETING, January 30-February 2.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS, Houston, Texas, February 18-21.

OMICRON KAPPA UPSILON, Philadelphia, March 15.

PSI OMEGA, Baltimore, March 18.

SIGMA DELTA EPSILON, Baltimore, Md., March 15-17.

XI PSI PHI, Baltimore, Md., March 18.

STATE SOCIETIES

February

Minnesota, at St. Paul (27-29)

April

Alabama, at Birmingham (9-11)
Arizona, at Tucson
Kansas, at Kansas City, Mo. (28-May 1)
Kentucky, at Owensboro (11-13)
Louisiana, at Monroe (18-20)
Massachusetts, at Boston (22-25)
Michigan, at Detroit (15-17)
Mississippi, at Jackson (15-17)
Missouri, at Kansas City (28-May 1)
Oklahoma, at Tulsa (14-16)
Texas, at Dallas (9-11)
Wisconsin (22-25)

May

Arkansas, at Little Rock (20-22)
California State, at Oakland (13-15)
District of Columbia, at Washington (19-23)
Georgia, at Macon (14-16)
Illinois, at Springfield (13-16)
Indiana, at Indianapolis (20-22)
Iowa, at Des Moines (6-8)
Montana, at Billings (2-4)
Nebraska, at Lincoln (20-23)
New Jersey, at Asbury Park (8-10)
New York, at Buffalo (14-17)
North Carolina, at Charlotte (6-8)
North Dakota, at Bismarck (5-7)
South Carolina, at Spartanburg (20-21)
South Dakota, at Sioux Falls (12-14)
Tennessee, at Memphis (13-16)
Vermont, at Burlington (15-16)
Virginia, at Lynchburg (13-15)
West Virginia, at Charleston (20-22)

June

Colorado, at Colorado Springs (20-22)
Connecticut, at New London (5-7)
Idaho, at Sun Valley (23-25)
Maine, at Lakewood (23-25)
Nevada, at Reno (8)
New Hampshire, at North Conway
New Mexico, at Santa Fe
Oregon, at Portland (12-15)
Pennsylvania, S. S. South American (13-16)

Utah, at Salt Lake City
Wyoming, at Rock Springs

August

Hawaii, at Honolulu

October

Southern California, at Los Angeles

November

Ohio, at Cincinnati

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, June 3, and at Los Angeles, June 24. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

New Jersey, June 24-29. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

Pennsylvania, at Pittsburgh and Philadelphia, June 18-22. Reuben E. V. Miller, 61 North Third St., Easton, Secretary.

Wisconsin, at Milwaukee, June 17-21. S. F. Donovan, Tomah, Secretary

GEORGIA DENTAL ASSOCIATION

THE seventy-second annual meeting of the Georgia Dental Association will be held at Macon, May 14-16, with headquarters at the Hotel Dempsey.

R. H. MURPHY, *Secretary,*
920 Ga. Gas Bldg.,
Macon.

KENTUCKY STATE DENTAL ASSOCIATION

THE Eightieth Annual Meeting of the Kentucky State Dental Association will be held in the Owensboro Hotel, Owensboro, April 11-13.

J. L. WALKER, *Secretary,*
640 Barbee Way South,
Louisville.

MISSISSIPPI DENTAL ASSOCIATION

THE next meeting of the Mississippi Dental Association will be held at Jackson at the Robert E. Lee Hotel, April 15-17.

GEORGE P. EVANS, *Secretary,*
Jackson.

MISSOURI-KANSAS DENTAL MEETING

THE Missouri-Kansas Dental Meeting will be held in the Municipal Auditorium, Kansas City, Mo., April 28-May 1.

ROY L. FELKNER, *Chairman of Publicity,*
Shukert Bldg.,
Kansas City, Mo.

DENTAL SOCIETY OF THE STATE OF NEW YORK

THE Seventy-Second Annual Meeting of the Dental Society of the State of New York will be held in Buffalo, May 14-17, at the Statler Hotel.

JOSEPH W. MARTIN,
Chairman of Publicity,
399 Seneca Parkway,
Rochester.

PENNSYLVANIA STATE DENTAL SOCIETY

THE Seventy-Second Annual Meeting of the Pennsylvania State Dental Society will be held aboard the S. S. American of the Georgian Bay Line, June 13-16, from Erie, Pa.

C. J. HOLLISTER, *Secretary,*
217 State St.,
Harrisburg.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

THE next examination by the Board of Dental Examiners of California for a license to practice dentistry and to practice dental hygiene will be held at the Physicians and Surgeons College of Dentistry and the University of California in San Francisco, commencing June 3, and in Los Angeles in Room 804, City Hall, commencing June 24. All credentials must be in the office of the secretary at least twenty days prior to the date of examinations or the candidate will not be eligible for the examination. Address all communications to

KENNETH I. NESBITT, *Secretary,*
515 Van Ness Ave.,
San Francisco.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations, commencing Monday, June 24 and continuing for five days thereafter. On application to the secre-

tary, a copy of the requirements and rules for applicants, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application blank, together with the examination fee of $25 on or before March 15 for the succeeding June examinations or before September 1 for the succeeding December examinations.

W. A. WILSON, *Secretary,*
148 West State St.,
Trenton.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will conduct examinations in Philadelphia and Pittsburgh, June 18-22. For information and applicant blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg, or

REUBEN E. V. MILLER, *Secretary,*
61 North Third St.,
Easton.

WISCONSIN BOARD OF DENTAL EXAMINERS

THE next examination of the Wisconsin Board of Dental Examiners will be held June 17-21 at Marquette Dental School, Milwaukee. For further information, address

S. F. DONOVAN, *Secretary,*
Tomah.

FIVE STATE POST GRADUATE CLINIC

THE Eighth Annual Five State Post Graduate Clinic of the District of Columbia Dental Society will be held May 19-23, at the Willard Hotel, Washington.

DAVID J. FITZGIBBON, *Chairman,*
Publicity Committee,
1801 Eye St.,
Washington.

AMERICAN ASSOCIATION OF DENTAL SCHOOLS

THE Seventeenth Annual Meeting of the American Association of Dental Schools will be held in Philadelphia, March 15-17, with headquarters at the Benjamin Franklin Hotel.

G. D. TIMMONS, *Secretary,*
Indiana University School of Dentistry,
Indianapolis, Ind.

AMERICAN COLLEGE OF DENTISTS

THE American College of Dentists is sponsoring a full day program for March 17 at the Belvedere Hotel, Baltimore. In the evening, a special convocation of the college will be held. The meeting throughout the day is open to the profession.

O. W. BRANDHORST, *Secretary,*
4952 Maryland Ave.,
St. Louis.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

THE next meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held Monday, March 25, at the Midston House, 38th St. and Madison Ave., New York, N. Y. Dinner at 7 p.m.; scientific session at 8:30 p.m. Elmer Andrew Rovenstine, M.D., professor of anesthesia at New York University College of Medicine, will speak on "Recent Studies on Nitrous Oxide Anesthesia; Their Practical Significance."

HARRY J. FIELD, *Secretary,*
130 Market St.,
Newark, N. J.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

THE Nineteenth Annual Meeting of the Southwestern Society of Orthodontists will be held at the Rice Hotel, Houston, Texas, February 18-21.

R. E. OLSON, *Secretary,*
1001 Union National Bank Bldg.,
Wichita, Kan.

CLEVELAND DENTAL SOCIETY

THE Annual Spring Clinic Meeting of the Cleveland Dental Society will be held April 8-9 at the Statler Hotel.

IRWIN F. STEUER, *Chairman,*
Publicity Committee,
562 Rose Bldg.,
Cleveland, Ohio.

DENTAL CENTENARY CELEBRATION

THE one hundredth anniversary of the founding of professional dentistry will be celebrated in Baltimore, Md., March 18-20.

MEYER EGGNATZ, *Secretary,*
Medical Arts Bldg.,
Baltimore, Md.

OMICRON KAPPA UPSILON

THE Twenty-Fifth Anniversary Meeting of Omicron Kappa Upsilon will be held in conjunction with the annual meeting of the American Association of Dental Schools, Philadelphia, March 15, at the Benjamin Franklin Hotel.

G. W. TEUSCHER, *Secretary,*
311 E. Chicago Ave.,
Chicago.

PSI OMEGA LUNCHEON

A PSI OMEGA luncheon will be held under the auspices of Oriole Alumni Chapter at the time of the Dental Centenary in Baltimore; March 18, 12:30 p.m., at the Emerson Hotel. Psi Omegas will please register during the meeting in Room 327, Hotel Emerson.

JAMES H. FERGUSON, JR.,
Grand Master,
National Alumni Chapter,
Medical Arts Bldg.,
Baltimore, Md.

XI PSI PHI MARYLAND STATE ALUMNI CHAPTER

THE Maryland State Alumni of Xi Psi Phi have planned a stag reception for the active and alumni members of the fraternity, to be held at the Lord Baltimore Hotel, Monday, March 18 at 5:15-6:30 p.m. Representatives from various chapters throughout the country have been invited. Refreshments will be served. There will be no speeches. Registration at the Lord Baltimore Hotel.

KYRLE W. PREIS, *President,*
Maryland State Alumni Chapter,
700 Cathedral St.,
Baltimore, Md.

SIGMA EPSILON DELTA

IN conjunction with the celebration of the National Dental Centenary in Baltimore, Sigma Epsilon Delta will hold its annual convention, March 15-17, the three days preceding the Centennial.

DAVID P. FRUCHTBAUM,
Chairman of Publicity,
4664 Park Heights Ave.,
Baltimore, Md.

ASSOCIATION OF DENTAL ALUMNI OF COLUMBIA UNIVERSITY

THE Association of Dental Alumni of Columbia University invites all graduates of the Columbia University School of Dental and Oral Surgery to Alumni Day, February 12. The program will be presented at the university, 116th St., and the central meeting place for all graduates will be Alumni House. For further information, address

JOSEPH R. HORN, *Chairman,*
617 W. 168th St.,
New York, N. Y.

NORTHWESTERN UNIVERSITY DENTAL SCHOOL LUNCHEON

NORTHWESTERN University Dental School will hold its annual Midwinter Luncheon in the Grand Ball Room of the Stevens Hotel, Wednesday, February 14, 12 noon, in conjunction with the Midwinter Meeting of the Chicago Dental Society. Franklyn Bliss Snyder, new president of Northwestern University, will be the speaker.

GEORGE W. TEUSCHER, *Secretary,*
55 E. Washington St.,
Chicago, Ill.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

THE Sixteenth Annual Session of the American Dental Assistants Association will be held at Cleveland, Ohio, September 9-12, with headquarters at the Cleveland Hotel. For further information, address

LUCILE S. HODGE, *General Secretary,*
401 Medical Arts Bldg.,
Knoxville, Tenn.